The Builder.

VOL. XCI.—No. 3320. SEPTEMBER 22, 1906.

ILLUSTRATIONS.

New Organ, Cheltenham College Chapel.....Mr. H. A. Prothero, F.R.I B.A., Architect.
A Competition Design for the Peace Palace at the Hague.....By Mr. G. A. Bligh Livesay, F.R.I.B.A.
City Chambers, Leeds.....Messrs. Perkin & Bulmer, Architects.
Font Cover, Walsham-le-Willows.....Mr. W. G. Horseman, Architect.
Font Cover Counterpoise Weights, Loughborough.....Mr. W. S. Weatherley, F.R.I.B.A., Architect.

Illustrations in Text.

The Development of Iron and Steel Roof Design.—I.:—
Diagrams of Roofs: Figs. 1 to 8 ..... Page 338
Premises: Nos. 41 & 43, Maddox-street. Mr. W. S. Weatherley, F.R.I.B.A., Architect..... Page 345
Illustrations to Student's Column:—
Figs. 78 to 100 ..... Page 346
Builders' and Contractors' Column:—
Greathead Shield for a 12-ft. Tunnel..... Page 348
Competition Design for Peace Palace at The Hague. Plan of Principal Floor ..... Page 350
City Chambers, Leeds. Plans ..... Page 351

CONTENTS.

	PAGE
The Development of Iron and Steel Roof Design.—I.	337
Notes	340
Notes on Mosaic and Marble Inlay.—I.	341
Premises, Maddox-street, W.	344
The Student's Column	344
Builders' and Contractors' Column	347
Architectural Societies	349
Correspondence:—	
Reason and Tradition	349
Estimating for Excavation and Concrete Work	349
Books Received	349
Fifty Years Ago	349
Illustrations:—	
Organ, Cheltenham College Chapel	350
Competition Design for the Palace of Peace at The Hague	350
City Chambers, Leeds	350
New Font Cover, Walsham-le-Willows Church, Suffolk	351
Font-Cover Counterpoise Weights, Loughborough Church	351
Metropolitan Asylums Board	351
Housing of the Working Classes in Middlesex	351
The Rotherhithe Tunnel	352
Rowntree's System of Reinforced Concrete	352
General Building News	352
Sanitary and Engineering News	353
Stained Glass and Decoration	354
Foreign	354
Miscellaneous	354
Legal:—	
Exeter Building Dispute	355
Newington Sewage Dispute	355
Patents	355
List of Competitions, Contracts, etc.	356
Some Recent Sales	359
Meetings	360
Prices Current	360
Tenders	361

The Development of Iron and Steel Roof Design.—I.

IRON and roof construction on a large scale may be said to have commenced with the Exhibition building of 1851, the chief members of which were afterwards incorporated in the Crystal Palace. As everybody knows, the original idea was due to Sir Joseph Paxton, but it is not so generally known that its realisation depended in great measure upon the assistance given by Sir Charles Fox on behalf of the contractors, Messrs. Fox & Henderson, of Birmingham.

The main arched ribs of the Exhibition building, like those of the Crystal Palace roof, were intended to act as girders without exerting lateral thrust, although provision for arch action was afterwards made by the addition of bracing between the supporting columns, thus enabling these members to act as abutments. Further progress was evidenced in the construction of the Crystal Palace by the skilful combination of cast-iron and wrought-iron in the roof of that building. The details of both designs were worked out by Sir Charles Fox, most of the working drawings being made by that gifted designer, Mr. R. M. Ordish, then engaged in the office of Messrs. Fox & Henderson.

The Crystal Palace roof may be looked upon as the prototype of some other arched roofs to which we direct attention hereafter, and its self-contained character may have suggested to Messrs. Fox & Henderson, with whom Mr. Ordish was still associated, the suitability of the arched trusses forming the principals of the roof erected in 1851-4 over the New-street station, Birmingham.

Fig. 1 is a diagrammatic representation of this roof, which has a clear span of 212 ft., and is a magnificent specimen of early engineering, still in serviceable condition.

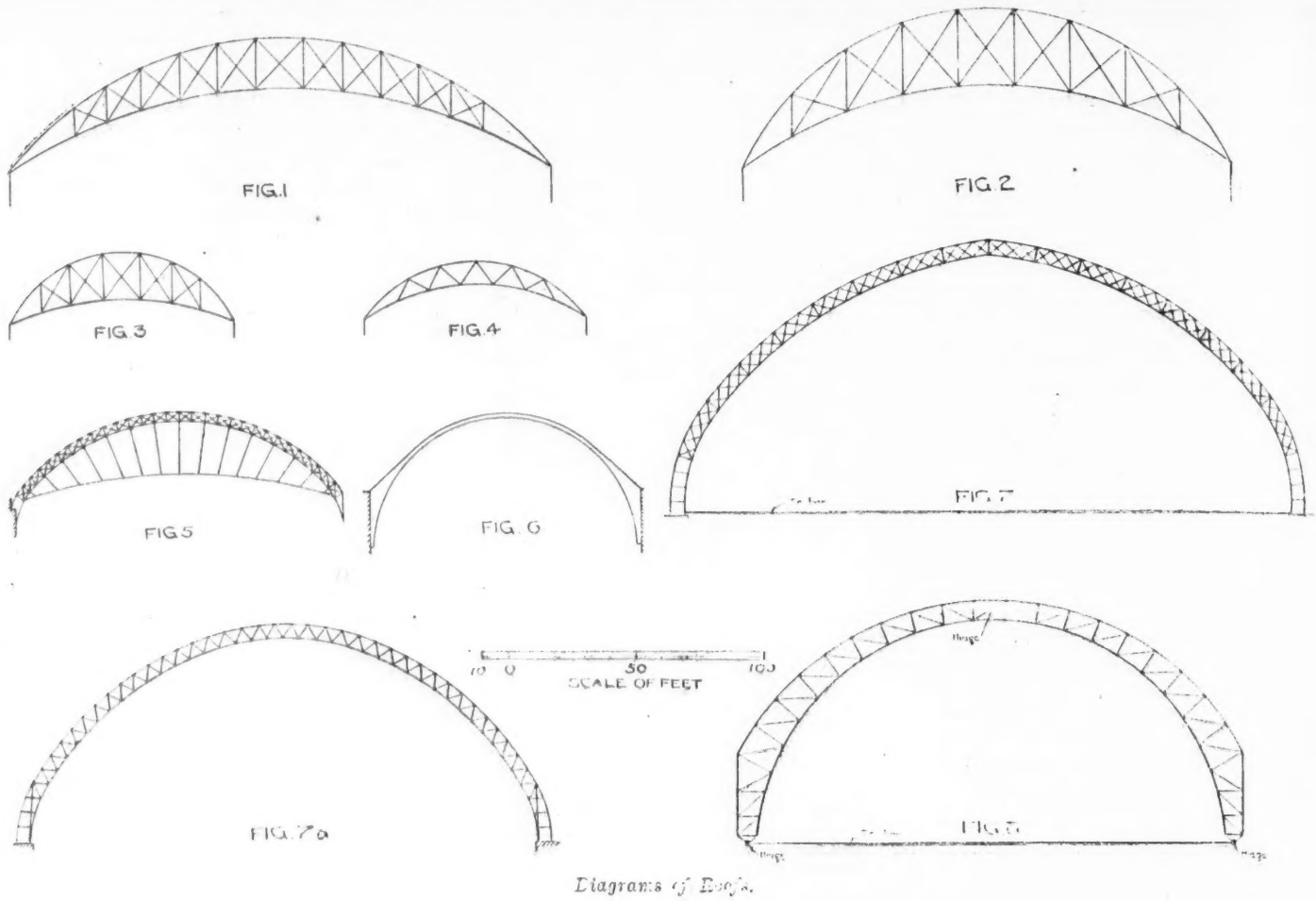
In consequence of the accident to the Charing Cross station roof, some question was raised as to the safety of the roof at New-street, more particularly as this was admittedly the model of the unfortunate structure in London. Therefore, it is worthy of record that the London and North-Western Railway Company have reliable evidence that at the time their Birmingham roof was erected each of the tie-bars was tested far beyond the stress it bears to-day, that when these bars was last examined they were shown to be absolutely sound, and that the ironwork of the roof generally is in an excellent state of preservation. We have the best authority for stating that when the next periodical cleaning and painting of the ironwork takes place the tie-bars will again be thoroughly examined, and that no apprehension is entertained by the company as to the stability of the roof.

The roof of Fenchurch-street station, designed by Mr. Berkeley, and built about 1851, was another historic structure until its replacement about four years ago by a new roof. The original design was similar in respect of the arrangement of the bracing to that at Birmingham, and one praiseworthy feature which redounds to the credit of Mr. Berkeley was the adoption of duplicate tie-bars at a time when the necessity for such a safeguard was not generally recognised by structural engineers.

As stated in our article of December 23 last,* the designs of the roofs for Charing Cross and Cannon-street stations were generally similar, but the details of the latter are superior in several respects. At Cannon-street the clear span of the roof is 190 ft. 4½ in., the rise of the rib at the centre being 60 ft., and the rise of the tie-bar 30 ft., making the truss 30 ft. deep at the centre. Each main truss consists of a segmental rib with a tie-bar and bracing as in Fig. 2. The main rib is a plate girder, 21 in. deep by 14 in. wide, the tie-bar has a uniform diameter of $5\frac{5}{16}$ in. throughout, in nine lengths, the ends of each being swelled out to form eyes which are secured by bolts to coupling blocks, and the vertical struts, dividing the principal into nine panels, consist of two T-bars bolted back to back with a stiffening plate to each bar, and the diagonals are plain bars 6 in. wide by ½ in. thick, these members bolted and riveted to a plate projecting from the coupling-blocks.

The east end of the truss is fixed, and the west end is provided with a rocking-saddle, beneath the bottom plate of which rollers are placed to provide for

* *The Builder.* Vol. LXXXIX., p. 662.



Diagrams of Roofs.

expansion and contraction, the object of the hinged foot being to insure that stress shall pass through the centre of the group of rollers under all circumstances. Thus the connexions of the tie-bar are not only more secure than were those of the former roof at Charing Cross, but by permitting more freedom of action they obviate the bending moments that are sure to be developed in the parts of a bar with rigid connexions. Further, the arrangement of the expansion device at the free end of the principal is in every way superior to the analogous arrangement at Charing Cross.

The wall construction of Cannon-street station is considerably thicker than at Charing Cross, to say nothing of the towers at the south end. Between the two towers is a gable screen consisting of two wrought-iron trusses of the same radius as that of the roof ribs and nearly horizontal at the bottom. These two trusses are spaced 11 ft. apart and connected so as to form one broad girder, which, being held down by wall bolts, constitutes a firm and effective bracing for the walls.

An undesirable feature presented by both the Cannon-street and the old Charing Cross roofs is that, as the ironwork is mounted upon exceedingly high walls, examination and maintenance are rendered unnecessarily difficult. Inspection, cleaning, painting, and renewals can only be conducted from scaffolds suspended from the roof principals, involving methods of work that are neither safe nor convenient. The risk of failure is distinctly accentuated by erecting ironwork in positions where it cannot be inspected easily and thoroughly, and the consequences of any partial failure are needlessly increased by the exaggerated form of a design that is good in itself, if carried out in accordance with all the precautions suggested by practical experience.

Among other early examples of roofs with segmental trusses one of the best known is that over the London Bridge terminus of the London, Brighton, and South Coast Railway, comprising a centre span of 88 ft., and two side spans of 87 ft. and 91 ft. respectively. The main features of the 88 ft. span are as follows:—The system of bracing is represented in Fig. 3, the main rib being a curved plate girder, the ends of which are bolted to columns. The tie-bar, of $2\frac{1}{2}$ in. diameter throughout, is made in separate lengths joined by screwed coupling-boxes somewhat similar to those at Charing Cross. The struts of the bracing are tubular and the diagonal ties consist of flat bars, the bracing being connected with the screwed coupling-boxes, by means of a saddle-piece on top of each coupling-box, the strut fitting into a socket, and the ties connected by bolts to projecting lugs. The strut is provided with a bolt, which passes through the middle of the coupling-box and serves to hold the saddle in place. This arrangement is certainly not one that would be adopted in the present day.

The old Blackfriars passenger-station (London, Chatham, and Dover Railway) possessed a roof of excellent design, which was removed when the station became converted into a goods depôt. The principals of the main roof had a span 87 ft. 3 in., the rib being a curved plate girder, and the tie-rod consisted of two parallel bars, having the uniform width of 5 in. and varying in thickness from $\frac{5}{8}$ in. to $\frac{9}{19}$ in. The bracing, of which Fig. 4 is a diagram, consisted of duplicate bars, the tie-bars and bracing being connected by a 2-in. diameter turned pin at the junction of the three members. This is a good method of construction, as the duplicate bars give the assurance of safety that is always to be desired in roof trusses of the kind.

Another important example is furnished by the roof of Lime-street station, Liverpool, designed by Sir John Fowler, and built by Messrs. Handyside & Co., in 1872-3. The main portion of the station, which was enlarged in 1875, has principals with an average span of 212 ft., the bracing being similar in arrangement to that in Fig. 4.

The main rib is a curved plate girder, the ends of which are supported on columns. The main tie consists of a series of four $5\frac{1}{2}$-in. by $\frac{15}{16}$-in. flat bars, placed side by side, the ends of the separate lengths of the links being swelled out to form eyes, connected at each joint by a steel pin $4\frac{5}{8}$ in. diameter. In every case the bars were forged solid without welds. Each member of the bracing consists of two angle bars spaced apart by cast-iron distance pieces secured by bands of half-round iron. The diagonals of the bracing are connected by $\frac{3}{4}$-in. web plates, each of which has an eye at the bottom through which passes the steel pin connecting the different sections of the main tie. At the top the bracing is connected in a somewhat similar way, but the web plates are riveted to angle brackets attached to the main rib. This roof is a very fine example of practical and theoretical design which it would be difficult to improve upon in the present day. Apart from its other meritorious features, the roof is quite safe from any accident such as that which overtook the unfortunate structure at Charing Cross, for with four solid forged links in each length of the main tie, one or two bars

in each length might break without involving failure of the principal affected.

A form of design somewhat resembling the Charing Cross roof in principle, although differing in points of detail, is typified by the roofs of Victoria station (London, Chatham, and Dover Railway), the Central station, Liverpool, and Queen-street station, Glasgow. Fig. 5 illustrates the general idea embodied in these roofs. Each principal is really an arch with the ends connected by a main tie-bar looped up by radial ties.

The roof at Victoria comprises two arches of 127 ft. and 129-ft. span respectively, one end of each being supported by roller bearings on brick walls, and the other ends fixed to the top of a cast-iron column. The bracing of the arch itself comprises a double system of triangulation and perpendiculars between the upper and lower flanges, the principals being spaced 35 ft. apart, centre to centre. This roof was designed by Sir John Fowler, as also was that of the Central station, Liverpool, which has nine principals of 160 ft. span, spaced 55 ft. apart. The general construction is similar to that of the Victoria roof, but it should be noted that all the tie-bars and rods are of steel.

Queen-street station, Glasgow, is the most important example hitherto built of the tied arch construction now under consideration. The roof includes nine principals of 170 ft. span and spaced 41 ft. 6 in. apart.

In the three last-mentioned examples single tie-bars are relied upon to take the thrust of the principals, an arrangement which, in view of the wide spacing between the principals, cannot be regarded as satisfactory.

Let us now turn to an entirely different type of roof, in which the principal of the arch is applied in such a way as to obviate the use of tie-bars.

The earliest arched roof for a railway-station was that at King's Cross, built in 1851, on a system entirely new in this country, the arched ribs consisting of a series of wooden planks held together with screws and trenails. The roof, included two spans of 105 ft., the abutments of which were constituted by the station walls and buildings. In 1869 the ribs over the arrival platforms were replaced by wrought-iron arches of similar shape, and in 1887 the roof over the departure platforms were similarly replaced, owing in each case to the signs of decay which became evident in the timber. Fig. 6 is an elevation of the new rib, which is practically a reproduction of the design employed in the Great Northern station at Bradford.

Paddington was the first railway-station to be spanned by wide and lofty iron arches. The roof was designed by Brunnel, and built by Messrs. Fox & Henderson, about 1856. It consists of three spans, the centre one 102 ft. 6 in., and those on each side of 70 ft., 68 ft., respectively. This is one of the most elegant structures of the kind in existence, and the simple method of ornamentation in the web of the ribs is particularly worthy of commendation.

The next noteworthy type of iron roof design in railway practice is illustrated in St. Pancras station, St. Enoch's station, Glasgow, and the Central station, Manchester.

St. Pancras station, completed in 1867, was designed by Mr. W. H. Barlow, F.R.S., then chief engineer to the Midland Railway, the design of the ironwork having been intrusted entirely to Mr. R. M. Ordish, to whom Mr. Barlow publicly gave all the credit for the fine engineering work represented by the roof in question. The main requirements of the case were that an unimpeded width of 240 ft. should be provided between the walls of the building, that the roof should be without complicated bracing and easy of access, and that buttresses should not be built outside the station walls. The design prepared by Mr. Ordish admirably fulfilled these conditions, and resulted in a distinctly novel form of railway roof construction, which is diagrammatically represented in Fig. 7. Each latticed rib is carried down to a massive base plate placed upon masonry foundations below the floor level, the abutments being formed by 20 ft. of solid brickwork. The ends of all the ribs are connected by girders below the floor level of the station, although it is doubtful whether any tensile stress actually comes upon these members.

The roof of St. Enoch's station, Glasgow (see Fig. 7*a*), has a span of 198 ft., and is very similar in general design to St. Pancras, although the bracing of the main rib is not quite the same, and there are no ties connecting the ends of the arch ribs. The ends of these members are secured to base plates bolted down to masonry foundations, and with the object of counteracting the outward spring of the arches the base plates extend 20 ft. inwards. This roof was designed by Mr. A. Galloway, and built by Messrs. A. Handysides & Co. in 1871.

The roof of the Central station, Manchester, on the same principle as that of St. Enoch's, has a span of 210 ft., and was built soon after the completion of the Glasgow roof.

The opinion is generally held that roofs of the St. Pancras type are unnecessarily extravagant in first cost, and have other disadvantages for which, however, railway managers of a past generation, and not the designers, must be blamed. As illustrating the change that has taken place with regard to this point, it is worthy of remark that in referring to the St. Pancras station, Sir Ernest Paget, the chairman of the Midland Railway Company, said that although the proprietors were proud of it as a triumph of engineering skill, it was an utter abomination as a railway-station from an economical point of view, and was incapable of lateral extension.

It ought to be pointed out, however, that the St. Pancras type of roof has been reproduced in various important structures on the Continent and in the United States within recent years. Some of the more modern examples of this class embody the principle of the three-hinged arch, a method of treatment which has the advantage of defining wind and load pressures.

The roofs of the new station of the Pennsylvania Railroad at Pittsburg and the Jersey City terminus of the same line both represent the St. Pancras type of design. These stations are practically alike, except in respect of some minor details, and the dimensions are approximately the same, being about 555 ft. long by 260 ft. wide by 110 ft. high over all. Fig. 8 is a diagram showing the general design of the trusses, which are of the three-hinged type, spaced alternately 9 ft. and 40 ft. 6 in. apart, and braced together in pairs, the vertical ends of the ribs being braced on each side of the building by a continuous line of lattice girders. The ribs have the span of 255 ft. between the centres of the end hinges, a rise of 93 ft., and the clear height of 87 ft. above rail level. The hinge at the crown is in the centre of a panel, where the diagonals are made extra heavy for the purpose of transmitting the stresses to the 5-in. centre pin which engages jaw-plates locking the two sections together. At the foot of each half of the rib a double-webbed shoe is riveted, having a semi-cylindrical bearing and jaw-plates engaging the lower hinge-pin and locking it to the pedestal. This pin receives the end of the horizontal lower chord or tie which connects the two ends of the rib and takes the thrust of the arch. The lower chord crosses the station in a closed trough below ground level, and is formed of a 12-in. I-beam in 30 ft. lengths riveted up by means of double web and single flange cover-plates. This roof was built in 1902 from the designs of Mr. W. H. Brown, chief engineer to the Pennsylvania Railroad Company.

Another American roof of similar type is that of the Drill Hall, in the Maryland Armoury, Baltimore, built in 1904. The roof covers an unobstructed floor area about 293 ft. long by 199 ft. wide, the space being spanned by ten three-hinged arch ribs, with a rise of 88 ft., the ends of which are joined below floor level by a tension member, consisting of two 8-in. channel bars for the purpose of resisting the outward thrust.

It is interesting to note that when the ribs of a roof, such as these examples, are adequately connected by horizontal chords, each rib really forms a series of bowstring girders of gigantic proportions, resting upon solid earth. Moreover, the public actually walk inside the girders instead of being many feet below them, as happens in buildings roofed over by trusses of the ordinary kind.

(To be concluded in next issue.)

INSTITUTE OF BRITISH DECORATORS.—The first gold medal of the Institute of British Decorators has been awarded by the Council to Sir William B. Richmond, K.C.B., R.A., in consideration particularly of his important decoration of St. Paul's. The presentation will be made at Painters' Hall, on Monday, November 26.

LONDON COUNTY COUNCIL CENTRAL SCHOOL OF ARTS AND CRAFTS.—The school will open for the eleventh session on Monday, September 24. The curriculum provides instruction in a wide range of artistic handicrafts, including bookbinding and typography, silversmiths' and goldsmiths' work, engraving and die-sinking, stained glass, embroidery, lace, dressmaking, miniature painting, cabinet work, carving and gilding, architecture, modelling, drawing, design, etc. Nominal fees only are charged, and apprentices, learners, and improvers are admitted free. A day technical school for boys, preparatory to the silversmiths' and kindred trades, has also been established and will open on October 1. Prospectus and full particulars can be had on application to the Secretary, 316, Regent-street, W.

NOTES.

The Labour Market. THE Memorandum of the Board of Trade issued by the Labour Department relating to labour in August records further improvement in the building trade, which at last seems to be sharing in the improvement in trade generally. The trade unions' returns as to the unemployed are also satisfactory, the percentage being 3·8, as compared with 5·4 per cent. in August, 1905. It is to be hoped that the unrest apparent in the leaders of the Labour party will be confined to the agitators and that this improvement in trade will not be checked by unnecessary strikes. The total number of workpeople affected by disputes in progress during the month was 14,096, or 3,191 less than in August, 1905, and the duration of the disputes 109,100 working days compares with 346,200 working days in August, 1905. Conciliation played an important part, changes of wages affecting 267,300 workpeople being arranged by mediation or conciliation boards, and we trust that the attitude of the delegates of the trade unions as exhibited at the recent Congress in no sense expressed the opinion of the workpeople towards efforts to extend the policy of conciliation.

Afforestation in the Isle of Man. A GOOD deal has been heard recently of the desirability of reafforestation on waste land in England. In the Isle of Man the question has been taken up practically, and it would seem with success. A recent inspection was, it appears from the Manx papers, recently made of a tract of mountain land of 18 acres near St. John's, between Douglas and Peel, on which some 50,000 coniferous trees have been planted. It appears from the inspection which took place this month that the trees are doing well; already, as even the casual visitor can see, they show appreciably much vigorous growth on the mountain-side. Unlike Scotland, the moorlands of the Isle of Man are not used as game preserves, so that one of the chief difficulties of reafforestation in Scotland does not exist in the Isle of Man. There can be no doubt that with care and proper supervision a large quantity of useful timber could be grown in Great Britain. It is not very creditable to the larger island that a lead should have been given in this matter by a small community like the Isle of Man, though the necessity for a home supply has no doubt been emphasised there by the paucity of woodland in the island.

Tunnel Ventilation. A PAPER of world-wide interest on the ventilation of railway tunnels is printed in the current issue of the *Proceedings* of the American Society of Civil Engineers. The author, Mr. Charles S. Churchill, has collected recent data relative to the condition of the air in various European and American tunnels which are valuable for comparison and guidance. His figures show that marked improvement has taken place since 1902 in the atmospheric conditions of such lines as the Metropolitan, District, City and South London, and Central London railways. For instance, on the Metropolitan Railway in 1902 tests made for the London County Council showed that the air in a carriage contained 28·8 parts of CO_2 per 10,000 volumes, while a sample of air taken from a car between Gower-street and Portland-road stations in June, 1905 contained 14·07 parts of CO_2 per 10,000 volumes, the outward air containing at that time only 1·75 parts. On the District Railway the air from a carriage contained 15·1 parts of CO_2 in 1902, and 11·27 parts in June, 1905, when the outer air contained 3·55 parts. The condition of both these lines will naturally be further improved when steam locomotives are finally abolished. On the City and South London, where artificial ventilation is not practised, the air is worse than in other tubular railways, the results of three different tests showing a proportion of CO_2 ranging from 8·69 parts to 14·2 parts per 10,000 volumes, or from three to five times the quantity found in the outer air. Since the application of fans to the ventilation of the Central London Railway the proportion of CO_2 in the carriages has been reduced by about 50 per cent., or from 3·7 times to 2·45 times the quantity in the outer air, which is a substantial improvement. The Great Northern and City Railway easily takes the first place, judging by a test made in July, 1905, when the air from a carriage was found to contain only 2·35 parts of CO_2 per 10,000 volumes, as against 1·75 parts in the outer air. The atmosphere on the Paris Metropolitan Railway seems to be almost as good as that on the last-mentioned line, but in the New York Subway the proportion of CO_2 is stated at 15·58 parts per 10,000 volumes, while the temperature is often exceedingly high.

Lightning-Conductors in America. DURING the present year manufacturers of cable in the United States have noticed a sudden increase in the demand for lightning-conductors, which had been dwindling steadily for several years. This is generally attributed to the action of the fire insurance companies, who have threatened to raise the rates of insurance on farm buildings, etc., unless they are efficiently protected from lightning. This sudden conversion of the American companies to a belief in the efficacy of lightning-conductors is noteworthy. Recent statistics prove that over 80 per cent. of the total losses due to fires in farm buildings, etc., in America have been caused by lightning. Fires due to this cause occur most frequently in wooden buildings, but stone and brick buildings have also been struck and set on fire. So far, however, no case has been recorded of a fire caused by lightning in a steel building. The *Electrical World* of New York, in commenting on the revival of the industry, gives some useful hints on the design of lightning-conductors. It is pointed out that greater protection is afforded by eight or ten galvanised iron wires 3 mm. in diameter than by the usual copper rod conductor of 15 mm. diameter. The thin wires are practically invisible. It is recommended that they be stretched vertically, joining a horizontal conductor on the roof with a parallel horizontal conductor on the ground. It is also recommended that two good "earths" be made with the lower conductor, and that all joints between wires should be soldered and painted. We think that the *Electrical World* lays too much stress on the superiority of iron to copper in this connexion. The only advantage of iron over copper are its higher melting-point and its greater specific heat. It can thus get rid safely of a larger amount of electrical energy than a copper conductor. In damp climates, however, and in the neighbourhood of chemical works, copper is much less liable to corrode than iron. The difference in the cost also is so trifling that it need not be taken into account. For protecting wooden barns, storing inflammable grain, a modified "bird-cage" network of telegraph wires is recommended.

Tests of Concrete-steel Beams. IN a pamphlet printed for circulation at the Brussels Congress of the International Association for Testing Materials, Dr.-Ing. Fritz von Emperger, of Vienna, states the results obtained by several series of tests upon reinforced concrete beams. The tests show generally that the breaking-weight of a concrete-steel beam depends very largely upon the adhesion between the concrete and the reinforcement, and serve as an indication of the manner in which the resistance of such beams can be increased. All the beams tested were of T-section, about 6 in. deep by 20 in. wide across the compression flange, and had the clear span of 6 ft. 6 in. between supports. The tests were conducted upon twenty-two beams of series A and C reinforced with two bars of $\frac{3}{4}$-in. diameter, and eight beams of series B reinforced with eight bars of $\frac{3}{8}$-in. diameter. Each series commenced with a beam reinforced simply by straight bars, and the others were provided with additional reinforcement in the form of bent-up bars and stirrups. The first beams of series A and B developed adhesive power equal to 80 lb. and 110 lb. per square inch respectively, while beams with stirrups gave from 240 lb. to 400 lb. per square inch for series A, and from 330 lb. to 550 lb. per square inch for series B, thus showing very conclusively the value of shear reinforcement as a means of increasing the adhesion between the concrete and the steel. For the purpose of ascertaining the effect of a mechanically perfect bond some tests were made upon beams in which the horizontal bars were screwed at each end and secured by nuts and washers. The effect of this arrangement was that all slipping of the metal was obviated, and that a surprising agreement was obtained between the elongations observed in the beams and those exhibited by specimens of the same material in the testing machine.

Wreck of the Duluth Swing Bridge. THE collision of a large lake steamer with the swing span of the Duluth-Superior bridge has provided one more illustration of the truth that the safety of a steel structure depends absolutely upon the integrity of its individual members, and has shown, with dramatic effect that such

structures are able to offer very little resistance against forces applied in directions not anticipated by the designer. The Duluth bridge, situated between the inner and outer harbours of the city, comprises two fixed bowstring girder spans and a swing span 501 ft. long. This span was struck about 20 ft. from the central pier by the stem of a steamer, approaching at dead slow speed, with the result that the compression booms of the truss were cut in two. One end of the span immediately sank into the channel, and a moment afterwards the other followed suit. The impact of the vessel pushed the whole structure on its bearings, but apparently without injuring the central masonry pier. It appears that the prevailing practice has been for the captain of a vessel approaching the bridge to signal for the span to be swung open and to keep on his way in the hope that the passage will be clear by the time the vessel has reached the entrance. The mishap affords another instance of the foolhardy risks habitually run in the United States, as the outcome of the feverish desire to save time which characterises the inhabitants of that country.

The Railway Disasters in America.

IT has been reported in the daily Press that the serious disasters which occurred this week on the Chicago Rock Island and Pacific and the St. Louis and San Francisco railways were both due to bridge failures. This is probably an error, for in the case of the former accident the true cause appears from the statement of a survivor to have been the undermining of the track running alongside the Cimarron river owing to severe floods. The result was that as the train passed over the fatal point the lines gave way and several of the carriages were submerged, thus drowning nearly all the inmates. In a country like the United States, where railways run through sparsely-populated regions, unexpected injury to the permanent way cannot be detected so readily as in Great Britain, but, as heavy floods have prevailed during the past fortnight on the section of the line affected, it is reasonable to suppose that the desirability of examination should have occurred to the railway engineers. Whether or not this precaution was taken we cannot say, but, judging by the happy-go-lucky manner in which railway traffic is conducted in the United States, we should imagine it was omitted. The second accident on the same river was due to the collapse of a railway bridge said to have been weakened by the floods of the past fortnight. We do not yet know whether the bridge was one of the flimsy structures through which American trains are in the habit of falling, or if it was one of substantial character whose stability was impaired by recently-undermined foundations. In the latter alternative the railway company would have no reason to anticipate danger, and can scarcely be blamed for lack of precautions. More detailed information on the point will be interesting.

The Swindon Tramway Accident.

IN our "Note" of July 14 last we referred to the probably defective condition of the magnetic brake of the runaway car which caused the death of five passengers and more or less serious injury to between seventy and eighty others. Colonel von Donop, in the Board of Trade Report now issued, confirms the opinion that the accident was primarily due to failure of the break mechanism. It appears, however, that this apparatus was less to blame than various officials employed in the tramway department of the Swindon Corporation. The car was a new one, with which the drivers had not thorough experience; it was placed on the route during the Bath and West of England Show, when a rush of traffic was clearly to be anticipated; and complaints had been made by drivers regarding it before the accident. In view of these facts, Colonel von Donop very reasonably concludes that the car ought not to have been used at all on the day in question, and that if used it ought to have been removed immediately upon the receipt of complaints. For the error of leaving the car on the route the traffic manager is held responsible, but in justice to him it should be mentioned that he sent a fitter to remedy the defect while the car was waiting at the Corn Exchange. The extraordinary thing is that neither this fitter nor the driver of the car displayed the least anxiety to have the brake put right, an adjustment that Colonel von Donop says could easily have been performed if these men had been willing to carry out their instructions. While tending in some measure to restore confidence in tramway brake mechanism, the Report throws into high relief the callous indifference which tramway managers and men are apt to display for the safety of the travelling public.

The Photographic Salon.

AT the first glance the fourteenth exhibition of the Photographic Salon at the Society of Water-Colours gallery seems really to promise some of that art-feeling in photography which we are told is to be developed; for Mr. Cadby's studies of children, which form the first five or six things in the catalogue, are really charming, and are quite out of the ordinary run of photographic work. We do not know how the effect is got, but they are very delicate photographs, in which white predominates, the hair of the figures being the only dark portion. He has been very fortunate in his children, who are full of natural character. These prints are therefore very well placed in the foreground of the exhibition, to beguile the visitor on; but we must confess that we soon get disillusioned, and find the exhibition mostly composed of work that is of little interest except as mere representation of fact. In this respect Mr. Mortimer's two sea-pieces (59 and 63) are very useful studies, and in the one called "Dirty Weather in the Channel" we are struck by a line of run of the waves which seems quite different from what one usually sees in a painting of sea. We have often remarked that architecture might well receive more attention in these exhibitions, as it is a class of subject for which photography is peculiarly fitted; and in this exhibition we notice more architecture than usual; but in some cases the value of photography in giving the sharpness and texture of architecture seems to be deliberately evaded, and Mr. A. Marshall makes Santa Maria della Salute and the Pantheon into misty phantoms. What is supposed to be gained by this treatment we know not; certainly Mr. F. H. Evans's sharp and precisely defined photographs of architecture are much more to the point, that of "Sunlight and Shadow, Mont St. Michel" (87) especially; we may also mention Mr. Kimber's "A Sunlit Cloister" (117). Mrs. Käsebier has found one or two good subjects in the bows and sterns of ships in dock, though they are very tame compared with what a good artist in charcoal would make of the same things. Among other exhibits Mr. Puyo's "L'Etang" (26) looks very like a picture, and Mr. Percy Wright has been singularly fortunate in catching just at the right moment the action of an old woman leading a couple of children through a village street—"The Truants" (139); it might really be a black and white sketch by an artist; but this is in the main a piece of good luck.

The Campanile, Venice.

THE work of reconstructing the Campanile at Venice has been temporarily suspended in consequence of a difference of opinion amongst architects and others as to how many steps there should be above ground at the base of the structure. In the old tower two steps were above ground, but it is now urged that three should be visible, and this and other matters are under consideration by the Commission. The new Campanile has been raised about 20 ft., but very little can be seen of it, as the work is surrounded by an unsightly hoarding, which in the circumstances cannot be removed for some time to come, much to the regret of artists and others. The bronze gates of the logietta, which were not much damaged, have been repaired, and Sansovino's Madonna has been reconstructed, the old pieces picked up after the fall of the tower being used.

NOTES ON MOSAIC AND MARBLE INLAY.—I.

IT is usual for writers on the subject of mosaic to commence with a refernce to the well-worn quotation from the book of Esther, which describes the pavement in the palace of Ahasuerus as made of perphry and white marble set together, as proving the antiquity of its use. The recent discoveries at Cnossos have, however, brought to light a much more ancient form of mosaic. Whether the curious porcelain plaques which represent the façades of houses were used for floor or wall decoration, the effect must have resembled *opus sectile*, and the fact that some of the windows are pierced through, while others are only sunk, suggests the probability of the inlaying of another material in the hollows. The sinkings also suggest the possibility of the use of some kind of mastic to fill them and make the surface level, as in the Roman *opus scalpturatum*.

The Egyptians and Assyrians do not appear to have made much use of mosaic or marble inlay for their floors or walls, preferring carving in low relief or painting on hard plaster (as at Tel-el-Amarna) or the breadth of effect of large slabs of stone; but in the museums examples may be seen of ivory carvings, with inlays of coloured stones and vitreous pastes on too large a scale for use as objects of personal adornment, which were probably parts of pieces of furniture. In the British Museum is a small Egyptian column decorated with mosaic, found at Port Said, ascribed to the VIth century B.C., and at Boulak is one of the same period found

in the Fayoum, showing that its use was not unknown to them. The Egyptian glass tesseræ, made by fusing together many rods of coloured glass arranged in a pattern and then cutting the mass across at right angles, are well known. Here we have what is to all intents and purposes mosaic on a very small scale, and the magnifying and modification of the manufacture is a small matter to an intelligent and mechanical people.

It is generally assumed, with great probability, that the art is Oriental in its origin and travelled westwards through Greece to Rome. The Greeks called it *psephosis*, from which the Arabs made the word *foseifisa*, though both Hesiod and Sophocles use *lithostratos*. In Latin the general names used are *lithostratum*, *opus musivum*, *mosaicum tesselatum* (from *tessela*, a die). *Musivum*, a late Greek work, is generally used for vitreous mosaic, as opposed to *lithostratum* for marble pavements. The only Greek example which has come down to us is the pebble mosaic in the temple of Zeus at Olympia (470-457 B.C.), and this does not give us a very high idea of the talent of the Greek craftsmen, being merely an imitation of a carpet not very well executed, but it is probably not very early. Pliny says that "lithostrata" were introduced in Rome in the time of Sylla (80 B.C.); at all events, there is still in existence a pavement formed of small pieces, which he ordered to be laid down in the Temple of Fortune at Præneste. The durability of the ancient pavements is mainly due to the extraordinary care which was bestowed on the preparation of the bed. Vitruvius gives curious details on the expedients adopted to ensure their lasting. "In order that the mortar at the joints may not suffer from the frost" (this is a slab pavement) "at the approach of winter every year it should be saturated with the dregs of oil, which will prevent the frost affecting it." "If extraordinary care be required, the pavement is covered with tiles, 2 ft. square, properly jointed, having small channels of the size of 1 in. cut on each edge. These are filled with lime tempered with oil, the edges being rubbed and pressed together. Thus the lime in the channels growing hard suffers neither water nor anything else to penetrate. After this preparation the upper layer (two parts of fresh rubbish, one of potsherds, and two of lime) is spread, 1 ft. thick, and beaten with sticks. Over this either large tesseræ, 2 in. thick, or angle tiles are laid at the inclination above directed (2 in. in 10 ft.), the pattern having been drawn and liquid cement poured on, an even surface being obtained by friction with marble, and work so executed will not be easily injured." The cement for finer mosaics was slaked lime one part, powdered marble three parts, mixed with water and white of egg. The Greeks made a kind of composition pavement for winter rooms, which was something of the same sort as the Roman *opus signinum* without the tesseræ of marble. The surface was excavated 2 ft. deep, the bottom was well rammed, and a layer of rubbish or potsherds spread over it with a slope towards the holes of the drain. "A composition of pounded coal (charcoal, of course), lime, sand, and ashes is mixed up and spread thereover, ½ ft. in thickness, perfectly smooth and level. The surface being then rubbed with stone it has the appearance of a black pavement." It was absorbent and warm to the feet of the slaves.

At first mosaic appears to have been used only for the pavements of temples, colonnades, and houses to which special distinction was desired to attach. From simple geometrical designs they progressed to those of a more complicated kind, lessening the size of the stones; then the imitation of natural objects commenced. The carpet already mentioned at the Temple of Zeus at Olympia is a *motif* of frequent occurrence. On the floors of triclinia they imitated the fragments of food thrown on the floor, and great reputation was gained by the "asarotus œcus," in which this imitation was carried to the verge of deception; so early were the true principles of art violated. Sosus, of Pergamon, was celebrated for these mosaics, an example of which is to be seen in the Lateran Museum; in the Capitoline Museum is a copy of one of his best-known works, found in the villa of Hadrian, a basin on the edge of which are two pigeons. The largest antique mosaic was found at Palestrina (the ancient Præneste), a curious geographical, zoological, and ethnographical picture of Egypt. A writer in *Archæologia* in 1790, says that it was made by Greeks, "as appears from the inscriptions." Another very large antique mosaic is that found in 1869 in the Piazza Vittoria, Palermo, and now in the Museo Nazionale in that city. Wherever the Romans went mosaic pavements are found, and it is unnecessary to multiply examples since the various museums are full of them. Reference may, however, be made to those discovered in North Africa, to the large one representing circus games discovered at Seville in 1799, and the enormous mosaics from the baths of Caracalla. The designs for the smaller floors are generally geometric, and the colours employed are few; if figures or animals are introduced, as became the case in the more important rooms in the IIIrd century, the arrangement is geametric, though the details may be free and even pictorial, as is seen in those found at Carthage and Sour. The most elaborate examples that can be quoted are the celebrated Battle of Arbela in the museum at Naples and the floor of Hiero II.'s pleasure gallery, which had subjects from the Trojan War. The artists who produced these elaborate works occasionally signed them, and Muntz gives the following list of names thus obtained:—Sosus (already mentioned), Dioscorides of Samos (who is said to have executed a comic subject for Cicero's Villa), Heraclitus, Proclus, Julius Soter, Fuscus, Prostatius, Ariston, Neithodorus. These ambitious works are rarely so successful as the simpler pavements in black and white, or with even five or six colours; the talent of the mosaicist seems to be overweighted and the palette overcharged. The columns and fountains decorated with mosaic now in the museum at Naples should not be overlooked, as showing another application of the material.

From the IVth century A.D. mosaic became the special decoration of religious buildings. The church of S. Costanza, on the Via Nomentana, close to S. Agnese, contains the earliest examples at Rome. The Liber Pontificalis says: "Constantine built the basilica of St. Agnes, saint and martyr, at the request of Constantia his daughter, and a baptistery in the same place, where was baptised, by the Bishop Sylvester, Constantia his sister with the daughter of Augustus." The mosaics remaining are those on the two apses and the vault of the aisle which surrounds the church. The vault is divided into eleven compartments with a grey ground, in several of which the same design is repeated. They are decorated with simple ornament, medallions and single figures, with branches of flowers, birds, and vases strewn over the surface, and two compartments show vintage scenes, the whole surface being covered with vine branches, among which naked children gather the grapes. The wine-press and the ox-wagons, which transport the grapes thither, are below on each side. The vault over the place where the sarcophagus of Constantia once stood (now in the Vatican Museum) has a gold ground. In the apses Jesus Christ is represented twice; in one case He stands blessing with His open right hand and holding in the left an unrolled scroll, on which is "Dominus pacem dat" and the labarum monogram; two apostles, Thomas and Philip, stand near; four lambs, which symbolise the faithful, are arranged in couples in front, and three streams of water; while two shapeless buildings at each end, sheltered by a palm-tree, suggest the two cities of Bethlehem and Jerusalem which appear so often. The apostles are robed in white. The other composition in which, seated on the globe, He gives the keys to S. Peter, with palm-trees, symbols of Judæa, making up the composition, has been copied in colour in the catacomb called Platonia. There may perhaps be earlier examples in the catacombs (which Gerspach says were executed by hands "guided rather by faith than talent"), such as the very curious one in the cemetery of S. Hermes representing the resurrection of Lazarus and the prophet Daniel.

The catacombs were used till Alaric's taking of Rome (410), but burials gradually ceased after the edict of Milan. The word catacomb is derived from the phrase "kata tumbas" (sometimes written "cumbas"), near the tombs ("of SS. Peter and Paul" understood) on the Via Appia, the catacomb of S. Sebastian. They generally have several stories, and as many as five even are known. A very complicated symbolism was gradually evolved, much of which was pagan in origin. The common symbols are the Anchor (sign of hope), the Lamb or Sheep, the Dove (the Christian soul freed from earthly bonds) with an olive branch (peace by the Bible). In later mosaics it sometimes represents the souls of the apostles. The Phœnix (the soul) is a later symbol, rarely found in the catacomb but sometimes carved on pagan tombs. The fish (Christ) is a symbol of the time of the apostles. The Cross is never painted in early times, but suggested by a bird with spread wings or a man praying with outstretched arms. The Greek "tau" was used instead of it also. The Good Shepherd, the Vine, the Wise and Foolish Virgins, and Noah's Ark are common; Jonah, Daniel, the Three Children in the Furnace, Adam and Eve, the Sacrifice of Abel and Cain, Elijah in the Fiery Chariot, and the Raising of Lazarus, all symbolising Resurrection. Baptism is symbolised by Moses Striking the Rock and the presence of Deity by a hand issuing from a cloud. The figure of Christ does not appear till the IVth century. The Virgin appears often in the IIIrd, and in the catacombs of S. Priscilla is a picture of her seated, which De Rossi thinks nearly of apostolic age. The figures called "Orantes" are regarded as symbols of prayer; sometimes they may mean the Church on earth on the soul of the dead praying for salvation. The holy mysteries are only occasionally represented. Flowers and trees are generally symbols of Paradise. In the catacombs of S. Domitilla the story of Psyche appears, and Orpheus is of frequent occurrence. After Constantine's Edict the Lamb becomes an important symbol. The stag at the fountain symbolises baptism and the 42nd Psalm, the peacock and eagle triumph, and the palm and crown martyrdom. In the Primitive Church the attitude of prayer was either prostrate with hands raised to Heaven or with the arms stretched out crosswise or standing; never kneeling. The nimbus was very rarely used in Christian art before the IVth century; at S. Costanza Christ has it (a large disc of gradated blue), but not the apostles. In S. Agatha, Ravenna (400), Christ has a cruciferous nimbus and the angels simple circles. At S. Maria Maggiore, Rome, Herod has a nimbus, and at S. Vitale, Ravenna, one is given to both Justinian and Theodora. In a mosaic of the Triumph of Neptune and Amphitrite, found near Constantine, in Algeria, both Deities have it. The Throne in Heaven appears, the twenty-four Elders and other symbols form the Apocalypse, the four beasts the symbols of the Evangelists. The book with the seven seals, the candlesticks, the four angels, and the Lamb was so commonly used as the symbol of Christ that the Council of Constantinople (693) decided that it was no longer to be used, since there was danger of the figure of Christ being left out altogether. The rules for the distribution of subjects over the walls and vault had the force of laws for 800 years, from the beginning of the Vth to the end of the XIIIth century. The great arch in front of the sanctuary was reserved for symbols of the triumph of religion, and was therefore called the "triumphal arch." The apse and tribune very often repeated these symbols, but completed the subject by the representation of holy personages, thus forming a picture of which Christ was always the centre. The nave walls were reserved for narrative compositions, scenes from the Old and New Testaments, parables, etc. Until the end of the VIIth century baptisteries were always outside the church. To encourage the building of churches Constantine freed from taxation architects, painters, sculptors, and mosaicists. M. Gerspach says his successors imitated him, and so a school was formed on the shores of the Bosphorus.

The church of S. George, Thessalonica, was built by Constantine during his first stay in that city, according to Texier and Pullan, and the bricks bear Christian stamps. The cupola is covered with mosaics—rich palaces in the style of the Pompeian paintings, with curtains looped to the sides and hanging lamps, peacocks, and richly-dressed figures in adoration with raised hands standing on

a patterned pavement in perspective. "In the centre of each of these compositions is a little octagonal or circular house, surrounded by columns and covered by a cupola; it is screened off by low barriers, and veils conceal the interior. A lamp suspended from the ceiling indicates its character; it is the new tabernacle, or *sanctum sanctorum*, of the Christians." There is a great variety in the design of these little temple buildings; in one instance there are no veils but lamps hung beneath each arch; in another in which the curtain appears there are four columns and a dome with three steps, evidently a high altar; in another there is a ciborium with a lamp suspended, but neither veil nor altar, in the centre of a semi-circular apse. There are ten principal colours used, but the tints are infinite, and the tesseræ are all vitreous. "The outline of each figure is marked by a dark shade, and the middle is filled with cubes, which are arranged so as to follow the outline." In S. Sophia, Thessalonica, the bricks in the women's gallery are stamped in the same way as those in S. George. The dome has a mosaic of the Ascension on a gold ground. The Virgin and the Twelve Apostles surround the dome, separated by trees. The Christ is in the centre, but an Arabic inscription leaves only his feet visible. The figures are more than 12 ft. high. In the apse is a Virgin seated with the infant Jesus; on the walls is a diaper on a square base, with a silver cross and vine leaves. At Eski-Djouma, a church which resembles the very early church of S. Demetrius in design, the soffits of the arches have good mosaic decorations on a gold ground in the parts not plastered.

The vault of the chapel of S. Rufinus in the Lateran Baptistery is of the end of the IVth or beginning of the Vth century; on a blue ground large foliated volutes unroll, green touched with gold. In the church of S. Pudentiana, Rome, is a fine mosaic, which has been ascribed to the VIIIth century, but an inscription formed part of it before Cardinal Gætani reconstructed the church in 1598, which ran, "Maximus fecit cum suis." De Rossi found fragments of inscriptions in the church, which showed that under the pontificate of Siricius (390-5) a certain Maximus did great works, taking eight years to execute them, at his own cost. This seems to make it certain that the mosaic is really of the IVth century. Barbet de Jouy calls it the most remarkable mosaic in Rome. The church itself may be considered as one of the most ancient in that city, having been founded by Pius I. of Aquileia on the site of the house of Pudens, though repaired by Adrian I. (772-795), having become ruinous The composition is good, the drawing firm and expressive. S. Praxedes is remarkably beautiful; the head of S. Peter is in a grand style, and to find an equally fine type one must go back to the heads of the apostles on those previous fragments of gilded glass worked with the point found in the catacombs near the tombs of the first Christians. In the centre Christ is enthroned, SS. Pudentiana and Praxedes offer martyrs' crowns of golden leaves, below are ten figures of the apostles. Above the figure of Christ is a barren hill with a jewelled cross upon it, and a semi-circular portico forms a background to the figures, above which buildings appear. In the sky the evangelists' symbols appear for the first time. Christ holds in His hand an open book upon which is written, "Dominus conservator ecclesiæ Pudentianæ." Some argue that the women's figures symbolise the Jewish and Gentile Churches.

From literary notices we know that there were French mosaics of the Vth century, but no examples have come down to us. A notice in the life of S. Laurence, Bishop of Siponto, a relation of the Emperor Zeno (474-91) shows how Italy looked eastward for its inspiration at that time. "When it was resolved to ornament with elegant and beautiful works the churches of S. Stephen and S. Agatha, situated near the Adriatic shore, and to build another close to the city in honour of the blessed S. John Baptist, he wrote to the Emperor hoping that their relationship would dispose him to receive his message favourably. He asked him to send him masters and workmen clever in all arts. The Emperor received the envoy of the Holy Bishop with joy, and charged himself with sending the most accomplished artists; further, with devotion and liberality, he charged them to carry to Siponto gold to contribute to the execution of the work and help in finishing the church. Having received this precious gift the holy man began and finished admirable and precious works in the basilica of the aforesaid martyrs; then he began another of a brilliant and wonderful beauty by the different colours and little pieces of glass covered with gold with warm reflections of which it was composed. He executed this work in honour of S. John Baptist in his Episcopal Church."

The mosaics in the baptistery of the cathedral at Ravenna date from about 435 A.D., and those of the mausoleum of Galla Placidia are but a little later. The baptistery was rebuilt by Neon in 430, though constructed or adapted by Ursus 100 years and more earlier. The centre of the dome shows the baptism of Christ, with the river God of Jordan on a gold ground. Round this central subject are figures of the Apostles on a blue ground, carrying crowns. Beneath these figures runs a broad frieze, on which four altars with open books of the Gospels upon them and thrones with crosses are represented between light columns. On the lower part of the wall are mosaics of gold wreaths on a blue ground, with figures of Saints in cartouche, and elaborate ornamental opus sectile in red and green porphyry. The tomb of Galla Placidia (SS. Nazzaro e Celso, 440 A.D.) contains mosaics of great delicacy. Here on a dark blue ground in the centre of the cupola is a golden cross with an aureole, and on the four pendentives the symbols of the Evangelists. There are doves drinking from a vase, stags drinking (both copied from the antique), and figures of eight apostles or prophets on the vaults. Above the door is the Good Shepherd among his sheep, young and beardless, seated and leaning on a cross; he has an immense simple nimbus, the sheep are six in number, and there are rocks and bushes round a gradated sky. Opposite is S. Laurence going to his martyrdom (described by some as Christ committing to the flames some heretical book). The drawing is good, the figures are dressed as Romans and fully draped, and the general colouring is harmonious. The ornaments and scrolls are gold or green, the draperies white, the ground a yellow-green gradually losing itself in the background. The chapel of S. Pier Crisologo, in the Archbishop's Palace, is a structure of the Vth century, and though much restored, altered, and added to, still contains remains of mosaics of that date. In the centre of the vault is the monogram of Christ supported by four angels, between them are the symbols of the Evangelists, and a beardless Christ is in the centre of the arch. The ground is golden. Above the altar are a Madonna in prayer and two Saints, which were originally in the cathedral. The arch above this has a diaper of crosses, with birds in the squares between.

The baptistery at the side of S. Restituta, at Naples, contains some remains of mosaics of the second half of the Vth century in a very bad state of preservation, and much mended with paint. It is square, with a low hemispherical cupola, which becomes octagonal in the lower part; the angles bear on cross arches, which form niches. The vault and the octagonal drum were decorated with mosaics by Bishop Sotera. The centre has a field of blue studded with stars of different sizes, the smaller of which are golden and the larger of silver, on which is the sacred monogram and A. & W. gilded; peacocks, doves, and other birds in the border feed on flowers and fruits in vases. At the summit the hand of God appears holding a crown of golden leaves enriched with sapphires and tied with ribands. A second zone surrounds the first, peopled with peacocks, doves, and other birds facing each other before a vase in the manner which we now know as Byzantine. The details have lost clearness, but the attitudes are natural and the vases elegant. Then come eight compartments with bands of ornament, arabesques, birds, and vases of flowers and fruits, which get larger as they near the base of the dome. Of the compositions between only five remain, facing each other, and two of these have been repainted, the Supper at Emmaus and the Evangelical Salutation. The one in a tolerable state shows Christ standing on a blue globe giving the law to SS. Peter and Paul, with two palm-trees in the corners of the composition, called "The Gift of God." The saints have suffered a good deal. The third compartment contains two figures: one seated with a scroll receives the homage of a veiled woman, who kneels before him. The fifth compartment is partly mosaic and partly paint, and may perhaps represent the miraculous draught of fishes. The other two compartments are blank, though one shows traces of the figure of a kneeling woman. In the angles are symbols of the Evangelists on blue backgrounds, with stars and with red clouds, but S. Luke's bull has disappeared; they have neither wings nor nimbi. Above the niches are catacomb symbols and medallions, stags, lambs, and shepherds with palms. On the drum there are an enormous head of Christ, painted; below, two small, beardless Saints holding crowns, and robed in antique fashion; opposite, a bust of the Madonna, also painted; by her two Saints, one of whom holds a palm (XVIIth century work); in the centre of the wall opposite the window a painted grille, on each side of which a young figure advances holding a crown of gilded oak with a jewel in the centre. One is young and one is old; they are in Roman costume, and of good style. The general colour impression is grey-blue and green. The gold is of a greenish tint also. In S. Prisco, near Capua, are mosaics of the Vth century. On the vault are scrolls like those in the chapel of S. Rufinus in the Lateran baptistery. On the arch are three rows of rosettes with scrolls between, and in a lunette a bust of Christ in a circular frame. The ground of the vault is blue.

The Lateran baptistery, which was probably originally a bath in the house of Plautius Lateranus, had two chapels added to it by S. Hilary (in 461-7)—on the right that of S. John Baptist, in which the mosaics have been preserved; on the left that of S. John the Evangelist, in which they have been destroyed. The vault of the oratory of S. John Baptist has a gold ground; in the centre is a lamb surrounded by a circle of flowers enframed by a border of ornaments forming a square; this border is prolonged cross-wise. The angles of the vault are ornamented with scrolls, and four garlands of flowers, cut in their centres by the projections of the borders, bind the four angles of the central frame together. The eight sections of the field are each decorated with a couple of birds, who face a vase filled with fruit; the species are well-drawn ducks, paroquets, pigeons, and partridges. The lamb has a nimbus. The vases of fruit symbolise the earth, like the Pagan cornucopia. The birds express the elements —the duck, water; the partridge, earth; the pigeon, air; the paroquet, fire.

The triumphal arch of S. Maria Maggiore, Rome (the Liberian basilica, founded by Liberius I., 352-66, restored and decorated by Sixtus III., 432-40), bears the subjects of the Annunciation, the Presentation, the Adoration of the Kings, the Massacre of the Innocents, and Jesus among the Doctors. In the middle of the arch is a throne in a medallion, surmounted by the Cross, and with the Apostles SS. Peter and Paul at the sides of it; the towns of Bethlehem and Jerusalem finish the composition below. There are now thirty-six pictures above the windows in the nave; six were destroyed to open the arches to the Borghese and Sixtine chapels, three on each side, and seven of the thirty-six have been replaced by XVIth century paintings. The subjects are from the Old Testament, and the personages are dressed and armed like Romans. S. Paolo fuori was destroyed by fire on July 15, 1823. The triumphal arch has been restored, as nearly as may be reproducing that which Leo I. (440-61) put up. It shows the Apocalyptic worship: a colossal head of Christ surrounded by a rainbow, with the four Evangelists' symbols emerging from clouds above it, and with two angels at his side leaning on their sceptres, while the twenty-four Elders throw their crowns at his feet in groups of twelve. Lower down SS. Peter and Paul stand.

At Milan, in the chapel of S. Aquilinus, in S. Lorenzo, are two niches filled with mosaic, one of which, showing the Angel appearing to the Shepherds, in which the angel has no wings, but a long cross-headed pastoral staff, has been restored. The other shows Christ enthroned, surrounded by the Apostles, also seated. The ground is golden, and the Apostles have no nimbi. It much resembles

a primitive painting in the catacomb of S. Hermes. P. Garucci says that about 494 Bishop Lorenzo ornamented the churches of Milan with marbles and mosaics, and this is probably of that period.

At S. Sabina, on the Aventine, is a mosaic of the time of Celestine I. (422) on the western wall—an inscription in gold letters on a blue ground, and two figures of women on a golden ground draped like antique bas-reliefs, and representing the churches of the Circumcision and of the Gentiles. Probably the Apostles S. Peter and S. Paul were represented above them, without any other symbol.

The mosaics at Ravenna, for which Theodoric was responsible, were made by Roman workmen sent by the Prefect of Rome in answer to his request for stone and marble workmen. S. Apollinare Nuovo was built in the Vth century. Its twenty-four columns are of marble of Proconesos, brought specially from Constantinople. It was then called S. Martin "in cielo d'oro," because of the gold backgrounds to the mosaics in the apse, which were destroyed in the XVIth century, when it was reconstructed, and was the Arian Cathedral. The portions of Theodoric's work which remain are the large figures of Apostles and Saints between the windows and the twenty-six subjects from New Testament history above them. Of the same period is the baptistery of the Arians, afterwards known as the oratory of S. Maria in Cosmedin. The dome is covered with mosaics evidently suggested by those of the orthodox baptistery, but showing decadence in their style. The heads of the figures are larger, and between each couple is a palm-tree bearing dates. A throne with a jewelled cross upon it appears as the point towards which the Apostles advance. The figures in the central composition show the greatest falling off.

The church of S. Vitale is on the site of his martyrdom, and replaces a little chapel consecrated by Neon. It was built by Ecclesius (524-34), and consecrated in 547 by Maximian. Mosaics at one time entirely covered it above, and the lower walls were plated with marble. The mosaics still remaining are in the apse. On the soffit of the arch are busts of the Apostles, of SS. Gervasius and Protasius, sons of S. Vitalis, and of Christ. In the semi-dome Christ is shown enthroned on the globe, with angels on each side, and at one side S. Vitalis and at the other Ecclesius holding the church. Above the arch two flying angels hold a disc, and Jerusalem and Bethlehem fill the spandrils. Three windows are above this, the wall and spandrils enframing which have scrolls of vine issuing from baskets and vases with birds about them—motifs which are repeated on the vault. The lower part of the apse walls has on one side a mosaic of Justinian with his bodyguard and officers of the Court, and Maximian with attendant ecclesiastics, and on the other Theodora, with her ladies-in-waiting and chamberlain, apparently going from the Palace to the church. Both Emperor and Empress have large nimbi. The space between the apse and the great arch is pierced by two triple arcades beneath a semicircular arch; the whole is covered with mosaic. The four Evangelists are shown seated, beneath whom are standing figures of prophets. On the right beneath the lower arch the tympanum is filled with the subjects the Offering of Melchisedech, the Sacrifice of Cain, Moses as a Shepherd, and the Burning Bush; on the left the Three Angels Entertained by Abraham, Sarah at the Tent-door, and the Sacrifice of Isaac face them.

The rows of Saints in S. Apollinare Nuovo —virgins on one side approaching the Madonna and child, enthroned and attended by four angels, and men on the other approaching the throne of Christ, similarly attended, all bearing crowns, and separated by palm-trees—are the work of Agnellus (556-8) at the time when it was converted into a Catholic church.

The most important Eastern mosaics of this century were those of S. Sophia, Constantinople. The basilica was burnt during a tumult in 533. Justinian's architects—Anthemius of Tralles and Isidore of Miletus—reconstructed it with the help of 10,000 workmen, and in 559 he was able to open the church, crying as the festival procession entered: "O, Solomon, I have surpassed thee!" The interior was entirely covered with slabs of marble and mosaics on a ground of gold. These mosaics are the most delicate of the early Christian time; the tesseræ are all of vitreous pastes, and very small in the flesh, sometimes, indeed, only "half-a-line" thick, according to Kinkel. The bands of ornament further from the eye have stronger drawing, but the vault of the women's gallery is the place where the most delicate and elegant patterns have been put, being near the eye. The lunette over the door of entry, a Christ in majesty, with medallions of the Virgin and S. Michael on either side and a Byzantine Emperor in full State costume on knee and elbow in prayer at the feet of Christ, is considered to be the finest extant work of Byzantine art. Restorations were carried out in the IXth and in the XIVth centuries. Paulus Silentiarius in his poem on the church says: "Who once sets foot in this temple can desire nothing further." At evening the radiance of the light reflected from the metal work around the altar and the splendour of marble and mosaic was so great that "then it was as if under the arch of Heaven the multitude of stars sparkled. Also the shining church served as a landmark to the steersman afar on the sea; like a lighthouse it lighted his ship to the narrow entrance of the Bosphorus." Procopius also speaks most enthusiastically of its beauties: "When anyone enters there to pray, he feels immediately that this is not the work of art of men, but of the supreme Deity; and, raising his mind to God, it appears to him as large as Heaven, thinking it certainly not far off, and delighting himself in that blessed place to which his devout soul aspires. Nor is that the impression which the magnificent spectacle makes only on him who sees it for the first time, but it is renewed every time he returns, however often, as if he had never seen it before. For no one has ever had enough of it, and he who remains in the temple delights himself with that most grateful sight; and he who goes out still speaks of it, always more in wonder." Von Salzenberg says that the few remains of heads have considerable character, and that the draperies of the figures are well cast. The mosaics commence at the springing of the arches and vaults. On the western arch is a Virgin and Child and SS. Peter and Paul, much damaged. Of S. Peter only the head is left. S. Paul's head has gone, but his body remains. Between the nave windows on the south side are the figures of Authimus, Bishop of Nicomedi; a Basileos of Cæsarea, in Cappadocia; S. Gregory Theologos, patriarch of Constantinople; S. Dionysios the Areopagite, S. Nicholas of Myra, Gregory the Armenian, Bishop of Greater Armenia, and Isaiah. Above are the feet of angels. On the north side, higher up, are Jeremiah and Jonah and Habbakuk, of whom only part remains. Feet with sandals appear above them. On the eastern arch (covered up) is a medallion of the book, S. John Baptist on one side and the Virgin and child on the other. Below was a portrait of John Paleologos much damaged. On the arch of the Bema is an archangel on the south side, and in the small dome of the chamber from the western buttress four angels with uplifted hands; also in a cupola of the women's gallery small remains of the Descent of the Holy Ghost, cherubs on the pendentives of the great central vault, and a Virgin with a standing child, Jesus, robed in the apse vault. It is, however, probable that all these mosaics are posterior to the iconoclastic period of the VIIIth century.*

F. H. J.

CHURCH-HALL, SKETTY.—A church-hall was recently opened at Sketty, near Swansea. Mr. Glendinning Moxham, architect, prepared the plans for the work, the cost of which will be about 1,100*l.*

PARISH CHURCH, BROMHAM.—A fire, on the morning of September 11, destroyed part of the nave and roof, and burned out the tower, of St. Owen's Church, Bromham, near Bedford. The church contains some handsome monuments (which escaped destruction) to the Trevor and Dyve families, of whom was the royalist Sir Lewis Dyve. The church stands in the middle of the park: it was built *temp.* Edward IV., and was restored in 1844.

* To be continued.

PREMISES, MADDOX-STREET, W.

THESE premises, Nos. 41 and 43, Maddox-street, have been built for Mr. Edward Arnold, the publisher, and comprise storage, strong-room, and packing department in the basement, with extensive vaults under the roadway; manager's room, strong-rooms, sample-room, clerks' offices, and trade department on the ground floor; private rooms, etc., on the first floor. The second and third floors are for offices, with separate staircase, and further offices and rooms for caretaker are on the fourth floor. The building is equipped with hydraulic and other lifts, intercommunication telephones, and electric light. The front is of Portland stone to the first-floor level, and then Portland stone and Messrs. T. Lawrence's red bricks. The external woodwork to basement and ground floors, including lobbies, is of teak.

The general contractors were Messrs. E. A. Roome & Co., and the clerk of works Mr. W. Tidey. The constructional steelwork was supplied by Messrs. Homan & Rodgers.

Mr. W. Samuel Weatherley is the architect.

The Student's Column.

ROOFS: STRUCTURALLY CONSIDERED.—X.

17.—*Timber Roof Trusses.*

TIMBER is so convenient, so easily worked, and so cheap that it is never likely to be entirely superseded by other materials for roof principals and trusses of small span. Being protected from the weather, it is reasonably durable, and the chief objection against timber roof framework is the certainty of destruction in case of a serious fire.

At the present time, when the necessity for fire-resisting construction is becoming more and more recognised, it is clearly desirable that the continued employment of a highly inflammable material in roof design should be discouraged, at any rate, in cities and towns.

Apart from the flat roof-frame, which, from the structural standpoint, is analogous to a floor, and the *lean-to* frame, the most simple form of roof truss is that described as the *couple* (see Fig. 78).

Strictly speaking, however, this is not a truss, because the two sloping rafters do not constitute a rigid and unyielding frame. On the contrary, they are bound to spread under the influence of load, thus exerting pressure upon the supports in an outward direction. Consequently a roof embodying rafters so arranged comes under Class II., as defined in paragraph (1), p. 53 *ante*.

By the addition of a tie-beam securely connected to the foot of each rafter, as in Fig. 79, the lateral spread is counteracted, and the frame so formed may properly be designated a truss. A roof having framework of this type is known as a *tied-couple roof* or *couple-close roof*, and comes under Class I. of the general classification above mentioned.

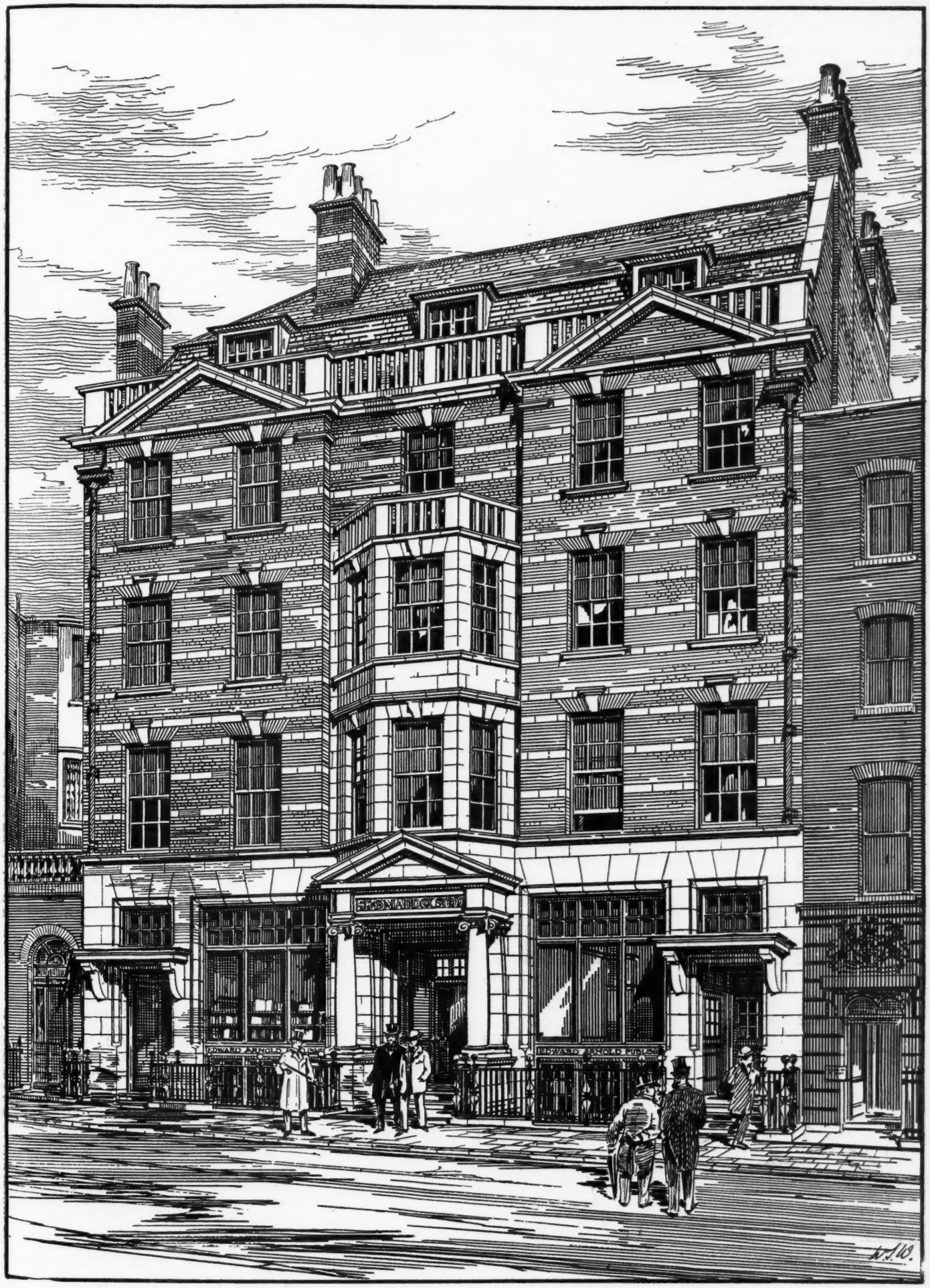
The tie-beams are generally of timber, because they can be used as supports for the ceiling. One disadvantage that follows the application of timber ties is that they are apt to sag slightly, and therefore tend to pull the walls inwards.

This effect can be prevented by the application of a further member to the truss connected with the ridge at the top and with the tie-beam at the bottom. The vertical member is termed a *king-post*, and Fig. 80 represents the most simple form of king-post truss.

When a truss of the construction here illustrated is employed in wide spans the permanent and occasional loads cause flexure in the rafters to such an extent that intermediate support is necessary between the ridge and the lower extremity of each rafter.

Horizontal struts, as in Fig. 81, might be introduced with good effect, but a far better method of affording the requisite support is to apply diagonal struts or braces, as shown in Fig. 82, which represents what is usually understood by a king-post truss, a form of construction suitable for roofs up to about 30-ft. span.

We have traced the development of the king-post truss from the simple couple without



Premises: Nos. 41 & 43, Maddox-street. Mr. W. S. Weatherley, F.R.I.B.A., Architect.

alluding to alternative methods of treatment, the object being to make clear the defects of the more simple types of truss and the manner in which such defects can best be remedied.

In some cases where it is thought desirable not to obstruct the interior by a tie-beam at the level of the side walls the two rafters forming a *couple* are connected by a *collar-beam* fixed about midway between the top of the walls and the ridge (see Fig. 83). A beam so applied acts as a strut or as a tie, according to circumstances. Assuming the walls to be capable of resisting the outward thrust of the rafters, the collar-beam constitutes a strut affording intermediate support for each rafter. On the other hand, assuming the walls exhibit a tendency to yield under the outward thrust of the rafters, the collar-beam acts as a tie with regard to the upper portion of the truss, but, of course, can have very little beneficial influence in the way of reducing the outward thrust exercised by the lower part of either rafter.

Collar-beam trusses, as illustrated in Fig. 83, do not represent good construction, and are not suitable for roofs of more than

about 18 ft. span. Even when so used the dimensions of the rafters must be proportioned with due regard to the length of their free ends, and the walls must be of ample strength so as to withstand outward thrust without appreciable movement.

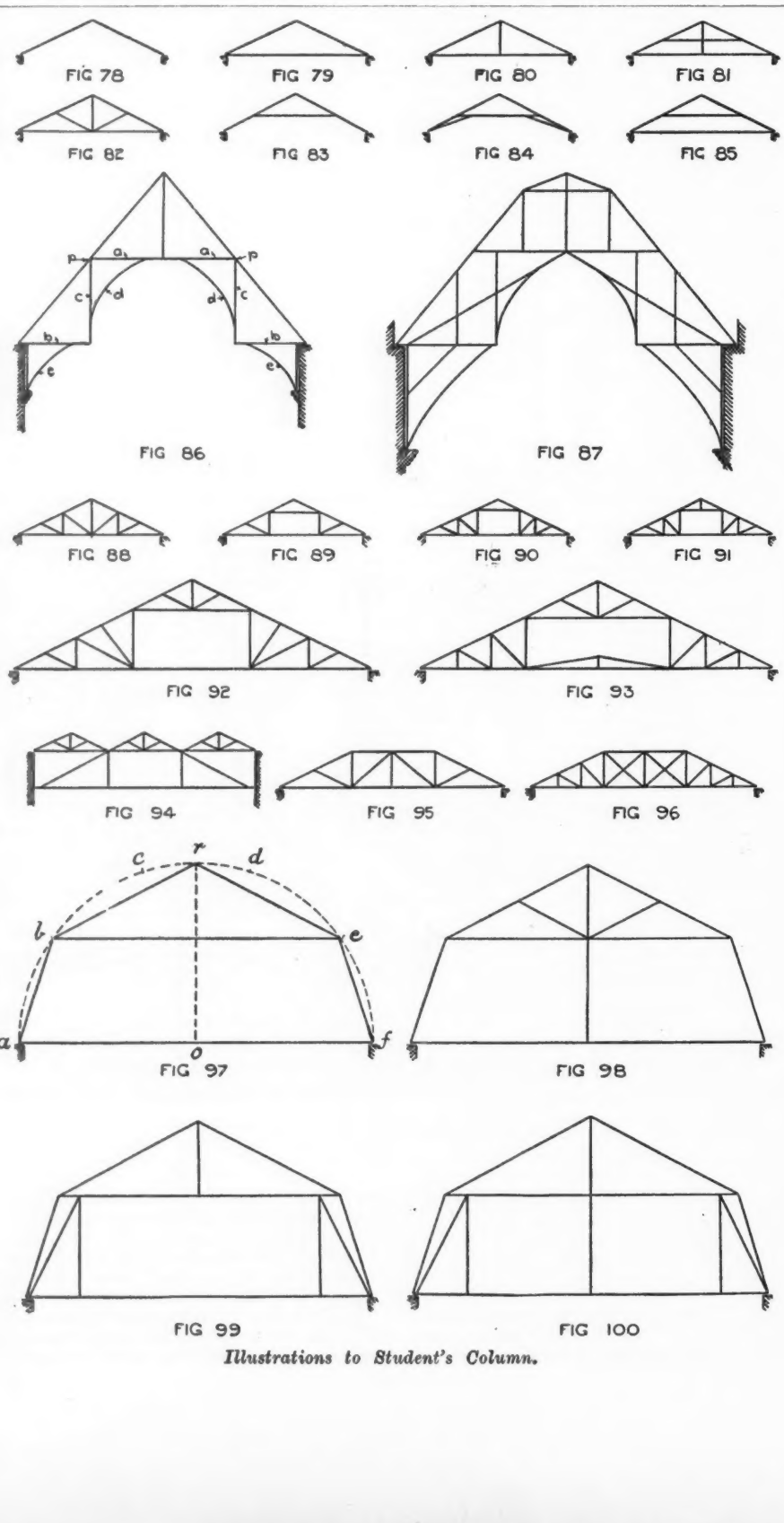
Fig. 84 shows a modification of the collar-beam truss, where tension members are fixed so as to tie the free end of each rafter to the collar-beam with the object of making good the weakness of the truss at its lower part. A still better form of construction is to employ a tie-beam as well as the collar (see Fig. 85), but, of course, the latter member does away with the only advantage to be derived from the substitution of the collar-beam for a king-post and diagonal bracing. When applied in conjunction with a tie-beam the collar-beam becomes a strut.

The *Gothic roof* illustrates the application of the collar-beam in conjunction with a *hammer-beam* attached to the foot of each rafter. In Fig. 86 *a*, *a* is the collar-beam, *b*, *b* are hammer-beams, *c*, *c* are struts. The three triangles formed by these members and the rafters would turn about the points *p*, *p* if not kept rigidly in position by something more satisfactory than the stiffness of the rafters.

A truss of this type can be rendered stable (1) by the application of tension members *d*, *d* connecting the hammer-beams with the collar, (2) by the application of compression members *e*, *e* resting upon corbels and acting as struts against the underside of the hammer-beams, or (3) by a combination of ties and struts.

The adoption of method (1) makes the truss a self-contained structure exerting pressure on the supporting walls in a purely vertical direction. Where method (2) is employed outward thrust is exercised by the roof truss, and the walls must be of adequate strength. In cases where the two methods are applied in conjunction matters are somewhat complicated, and it is not always easy to analyse the stresses actually developed.

We may cite the roof of the great hall at Hampton Court Palace as an example, illustrating the use of ties and struts in conjunction. The construction of the roof is diagrammatically represented in Fig. 87. All the members are so strong and so securely connected that if the bottom struts were taken away it is probable that the tension members would prevent the exercise of injurious thrust against the walls. On the other hand, as the weight of the roof is carried down so far below the hammer-beams by the wall-posts, the walls would be capable of resisting any strain following the removal of the tension members.



Illustrations to Student's Column.

Referring to Fig. 86, it should be pointed out that the hammer-beams *b*, *b*, although occupying positions usually associated with ties in the roof system, are really levers. The inner end of each beam carries half the weight of the upper portion of the roof, a load that is balanced to some extent by the weight of the rafter at the outer end of the beam. Of course, the additional force required to establish equilibrium is furnished by the tie *d* or the strut *e*, or by *d* and *e* in conjunction.

Reverting now to the king-post truss, as illustrated in Fig. 82, we must point out that this form of construction is only suitable for roofs of comparatively small span. When the span exceeds about 30 ft. it is found necessary to provide additional supports for the tie-beam and additional diagonal struts to stiffen the rafters.

In Fig. 88 the two vertical ties on either side of the king-post are termed *queen-posts*.

By leaving out the king-post and substituting a horizontal strut termed a *straining-beam* between the two remaining verticals, we have the *queen-post truss* (Fig. 89), which may be applied with confidence to roofs up to about 45 ft. span.

A convenient feature of the queen-post truss is that it affords space for the formation of rooms in the roof of a building.

For spans exceeding 45 ft. wide two intermediate supports are not enough for the tie-beam, and the queen-post truss is elaborated by the addition of other verticals distinguished by the term *princess-posts*, or simply *princesses*. A diagram of the modified design will be found in Fig. 90, this form of truss being suitable for roofs up to 60 ft. span. In cases where the straining-beam is of such length that there is risk of sagging, a small king-post is fixed between it and the ridge, as indicated in Fig. 91.

By extension of the principles outlined above timber trusses could be constructed of any span within the limits imposed by the mechanical properties of the material.

As the span increases the necessity becomes evident for additional members to support the rafters and tie-beam.

Assuming it were decided to design a timber truss of about 70 ft. span, the rafters between the ends of the straining-beam and the ridge would be stiffened by diagonal struts connected at the foot of the small king-post shown in Fig. 91, and those portions of the rafters between the queen-posts and the rafters would be supported by additional struts. Fig. 92 represents the truss as so modified.

In cases where the tie-beam requires further support the number of princess-posts can be increased, and that part of the tie-beam between the queen-posts can be stiffened by the addition of two ties and a vertical strut forming a rigid truss. The construction would then be as drawn in Fig. 93.

Another form of truss suitable for wide spans is that in Fig. 94, where three small king-post trusses are carried by a deep girder, which is practically a large queen-post truss with the apex removed and the addition of an upper horizontal beam, acting as a compression boom. The construction here illustrated involves the use of heavy timbers and extension of the walls above the level necessary for other types of truss previously described.

Fig. 95 shows a flat-topped truss having two queen-posts, one king-post, with two diagonal struts for supporting the straining-beam, and the usual struts as intermediate rafter supports. This form of truss is also suitable for wide spans.

Fig. 96 illustrates a somewhat similar truss for still wider spans, having two queen-posts, four princess-posts, a king-post, a double system of diagonal bracing in the two central panels, and single bracing in the outer panels.

The *Mansard*, or *curb*, roof, permitting the construction of a capacious and well-lighted attic story, is much used in this country, and under the name of the French roof has been very popular in the United States for many years past.

The usual method adopted in setting out the profile of a Mansard roof is that of Belidor, a distinguished French engineer, who lived a century and a half ago, and whose writings on timber construction remain

of practical value for the guidance of architects and engineers to the present day.

The method, illustrated by the broken lines in Fig. 97, is as follows :—

Bisect the line *af*—representing the span of the roof—at *o*, and draw the line *or* perpendicular to *af*. Upon the base *af*, with the radius *oa*, describe the semicircle *arf*, and divide it into five equal parts, *ab*, *bc*, *cd*, *de*, *ef*. Join *ab* and *ef* to give the sides of the lower portion of the roof, and *br* and *er* to give the slope of the upper portion.

The simple form of Mansard truss illustrated in Fig. 97 comprises two outer struts, a lower tie-beam, an upper tie-beam connecting the rafters, and a small king-post between the ridge and the upper tie-beam. The last-mentioned member is not shown in the diagram, because it would interfere with the broken line *or*.

A stronger form of the same kind of truss is shown in Fig. 98, where a stout king-post is carried from the apex down to the lower tie-beam, and two diagonal struts are added to provide intermediate support for the rafters.

Further rigidity is imparted by adopting the system of bracing in the lower portion of the truss as represented in Fig. 99. By carrying the king-post down to the lower tie-beam, as in Fig. 100, still further strength can be added to the construction, and if thought necessary diagonal struts can be included for intermediate support of the rafters.

Numerous other diagrams might be added of timber roof trusses suitable for different styles of architectural design, for wider spans than those hitherto contemplated, and for adoption in special circumstances. As the architectural consideration of roofs is beyond the scope of these articles, and as the modern tendency is to employ steel construction except for trusses of very moderate span, we have confined attention in the present article to typical examples most likely to be of use in ordinary structures.

Next week we shall take up the discussion of the details of simple forms of timber roof trusses.

Builders' and Contractors' Column.

THE CONSTRUCTION OF A TUBE RAILWAY.—III.

(Continued from page 276.)

Tunnelling with a Shield.

SHIELDS are chiefly employed for the purpose of supporting the ground and providing a protection for the men employed during the operations of excavating and fixing the iron lining of the tunnel; they also assist to a certain extent in the work of excavation, although the greater portion of this is done by hand labour.

The shields employed for tunnelling in London clay may be divided into two classes—(1) the small shields used for driving the running tunnels, and (2) the large shields used for stations and cross-over roads; these two classes, although similar in principle, differ considerably both in construction and in the method of working.

Considerable improvements have been made in the small shields since the first were used on the City and South London Railway, the most notable being the substitution of mechanical power for hand labour for moving the shields forward.

The shield now used for driving the running tunnels consists mainly of a cutting-edge, a skin, and the jack-castings and diaphragms forming the main support of the shield. The outside diameter is 2 in. larger than the outside diameter of the tunnel lining, and the over-all length is about 7 ft. 6 in.

The cutting-edge is of cast-steel, constructed in three sections bolted together, and is slightly larger in diameter than the skin in order to facilitate the passage of the shield through the clay.

The skin, which is about 6 ft. long, consists of a cylinder, constructed of ½-in. steel plates, with butt-joints and cover-plates, and extends from the cutting-edge, to which it is bolted, backwards beyond the ring of jack-castings for a distance of about 2 ft. 9 in., forming what is known as the "tail" of the shield. The object of this tail is to support the ground and protect the miners whilst erecting the iron lining.

Immediately behind the cutting-edge is a steel diaphragm, composed of two ½-in. steel plates, and behind this, again, are the jack-castings, which are bolted together, and form the chief support of the shield, as well as providing a firm fixing for the jacks.

The shield is driven forward by hydraulic rams or jacks, eight in number, having a stroke of 24 in. and a diameter of 7 in. Each ram can be operated independently, or the whole or any number can be operated at once, being controlled by a system of valves. On the upper part of the diaphragm an air-engine, or intensifier, is fixed, which is supplied with compressed air at a pressure of 60 lb. per square inch, and which raises the pressure, or intensifies it, to 2,240 lb. per square inch, at which pressure it forces water into the rams. The compressed air for working the intensifier is supplied by air-compressors, and installed on the surface, and is led to the shield in air-tubes along the tunnel already constructed, being connected to the intensifier by a flexible hose. The water for the rams is drawn from and returned to two tanks fixed on either side of the shield.

The shield is fitted with an oak grouting-rib, made in sections, placed in the tail of the shield between the ram-heads and the last ring of tunnel segments fixed. The grouting-rib serves a double purpose; firstly, it prevents the grout from running out until it has set, and secondly, it distributes the pressure from the ram-head more evenly over the cast-iron segments.

The total force which can be exerted by the rams for driving a shield for a 12 ft. 6 in. tunnel forward is about 300 tons, or about 7⅓ tons per foot run of cutting-edge; but in practice the force required generally varies between 150 tons and 250 tons.

A box-heading, strongly timbered, about 6 ft. high by 5 ft. wide, is driven ahead of the shield, and is always kept about 6 ft. or 8 ft. ahead of it. The heading is excavated by hand labour; two miners and two labourers working in it continuously, even whilst the shield is in motion, being just able to keep pace with the progress of the shield.

The cycle of operations for each ring is as follows :—

Let us assume that the shield is all ready to move forward, then the condition of affairs will be as follows :—The last ring of iron erected has been bolted up and grouted, the grouting-rib is in position, and is held there by the rams. The clay has been roughly trimmed to the shape of the cutting-edge for a distance of about 20 in., and the requisite number of piles have been placed in position. (Note.—The piles are of oak, about 3 ft. long by 6 in. by 2 in., and are shod with iron; they are placed against the front of the cutting-edge parallel with the skin of the shield, with one end resting in a small pocket cut in the clay face. The object of the piles is to burst out and bring down as much as possible of the clay between the cutting-edge and the box-heading as the shield moves forward, and the number used varies with the nature of the ground.) Planks have been placed from the heading to the platform of the shield to prevent the clay knocked out by the piles falling into the invert. The first two settings of the box-heading have been knocked away and placed across the entrance of the heading to protect the miners in it from the falling clay. All being ready the pressure is turned on, the rams commence to work, and the shield moves slowly forward. If the tunnel is straight the shield is allowed to advance the full stroke of the rams, but when on a curve the shield is stopped at half-stroke for the purpose of checking it for position.

At the end of the stroke the shield is stopped, the front portion being filled with loose clay knocked down by the piles. The pressure is reversed and the rams are drawn back and the grouting-rib removed; the invert of the tail of the shield is then cleaned out ready for the iron lining to be placed in position. Whilst the shield has been moving forward the segments, six in number, and the key-piece and bolts for one ring of tunnel have been brought up to the shield on trollies ready for fixing.

The two bottom segments are first placed in position in the invert, the wood packings are inserted in the circumferential joints, and the segments are then bolted up to the last ring fixed. The two side plates are then dealt with in a similar manner. A temporary stage is constructed about 5 ft. high to enable the miners to fix the two top-plates and the key; these are lifted on to the stage, and the lower end of each segment is placed on the top of the corresponding side-plate; the upper end is supported temporarily on a timber strut, and is forced upwards tight against the skin of the shield, being about 1 in. above the final position; the key can now be inserted, and when this is done the struts are removed and the two top-plates are allowed to come down into their correct position, gripping the key on either side. The whole ring is then bolted up and the stage removed.

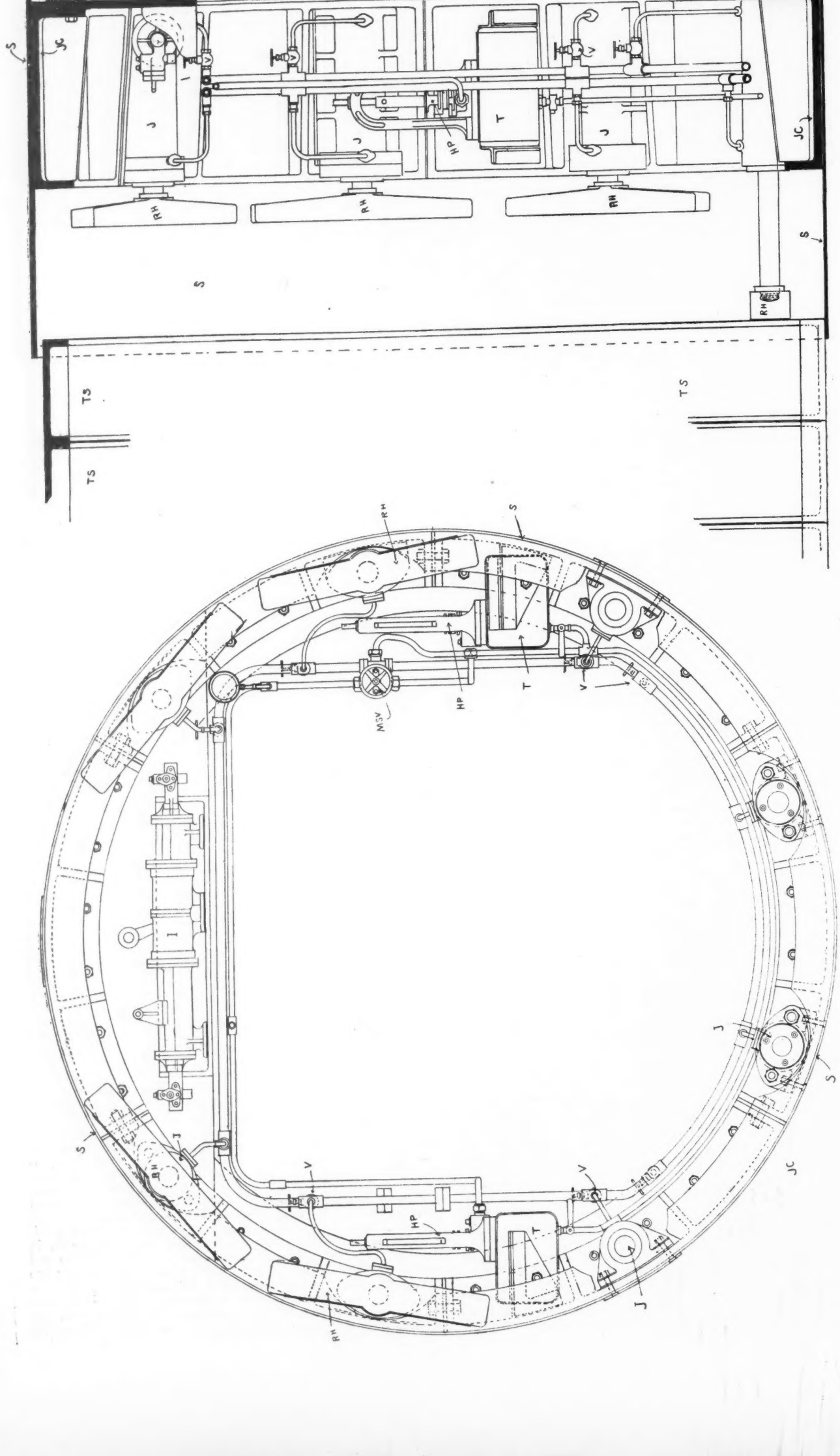
Whilst these operations have been in progress the miners have continued to work in the heading, and at the same time two men, using the heap of loose clay in front of the shield as a platform, have trimmed the ground out ahead of the shield for a distance of 20 in., and have refixed the piles ready for the next move forward. The loose clay is now removed from the shield and heading and the ring of segments grouted, and the cycle of operations is complete.

Forty rings a week is good progress, working night and day continuously.

Grouting.—This operation, which has been mentioned several times in these notes, is a most important one, as the safety of the buildings, mains, etc., along the route largely depends upon the manner in which it is done. The materials used vary considerably, the following having been used at different times :—Neat cement, neat blue lias lime, cement and lime in varying proportions, cement and sand, and lime and sand, in all cases having a considerable quantity of water with them. The grouting-pan consists of a strong steel cylindrical vessel, about 2 ft. 6 in. long and 1 ft. 6 in. diameter; a horizontal shaft runs through the centre, fitted with a number of blades, and is revolved by means of a handle. At the bottom of the cylinder is a nozzle, with screwed connexion, to which an armoured hose is coupled, the free end being held in the grouting-holes left in the tunnel segments. On the top of the grouting machine is a valve and screwed connexion, which is connected to the high-pressure air-main in the tunnel by means of a length of flexible armoured hose. There is also an opening in the top of the machine fitted with an air-tight door. The operation of the machine is as follows :—The cement or lime is placed in the grouting machine through the opening in the top and the necessary amount of water added, the handle being revolved meanwhile in order to agitate the mixture and prevent it setting. The air-tight cover is then securely screwed down, and the valve turned on, which admits air at a pressure of 60 lb. per square inch into the upper part of the machine, forcing the grout out of the lower nozzle through the hose to the space outside the cast-iron lining of the tunnel, which it completely fills.

Packings.—In order to prevent the grout running out between the rings of segments creosoted deal packings are inserted in the circumferential joints. These packings are cut to the pattern of the flange of the segments, and have holes bored in them to correspond with the bolt-holes in the segments. The packings vary in thickness from ⅜ in. to 1½ in., the thinner ones being used where the tunnel is straight and thicker ones where the tunnel is on a curve.

Guiding a Shield.—A tunnelling-shield has to be steered in two directions, viz., vertically and horizontally, and great care is needed to keep the shield in its correct position. For the purpose of checking the vertical movements of the shield adjustable boning-rods are used. These are fixed as follows :—One on the shield itself, one about ten rings back from the shield, and one about twenty rings further back; they are bolted to the top of the tunnel, and the adjustable cross-pieces are levelled with a dumpy level, so that the tops of the two boning-rods in the tunnel should line exactly with the rod in the shield. Should the shield be low the top rams are shut off and the bottom ones used to force it upwards, and in the same way, if it is too high, the bottom rams are closed and the top ones used. When the



Greathead Shield for a 12-ft. Tunnel.

tunnel is on a gradient the two boning-rods are set at such levels that the shield will follow the correct gradient if the rods bone through.

For controlling the horizontal movements of a shield two methods are employed. The first method is as follows:—Two plumb lines are suspended from the roof of the tunnel about 30 ft. apart, the leading line being about 10 ft. behind the shield; the lines are placed in position exactly on the centre line if the tunnel is straight, or on the tangent line if the shield is travelling round a curve. A movable centre-rod is attached to the shield, having the exact centre of the shield marked upon it. The plumb lines in the tunnel are set with a theodolite after careful calculations. To test the shield for position on a straight length the plumb lines are allowed to hang freely, and the centre-rod is placed in position in the shield; if the shield is correct the two lines will be in alignment with the centre mark on the shield-rod, and if the shield is off line more rams are used on one side in order to bring it back again. For checking the shield on a curve a table of offsets is calculated for every foot on the tangent line, which show how much the shield should be to the right or left of the tangent line at any point on the curve. If the shield is off line it is corrected in the same manner as when on the straight.

The second method was conceived by Mr. Dalrymple-Hay. In this method two guide-rods, about 25 ft. long, are attached to the back of the shield, and are drawn forward by it as it moves. The rods are divided into feet and inches, and pass along over two indices fixed in the tunnel, one on either side, square to the centre line. Now, if the shield is travelling correctly, the readings of the guide-rods at both sides of the tunnel should be the same, but if the shield is going off line one reading will be higher than the other. When going round a curve a special shrunk-scale is calculated for the rod on the inner side of the curve, so that both rods should still read the same when on a curve. The chief advantage of this method over the first one described is that the readings can be taken while the shield is in motion, and indicate much more quickly if the shield is travelling off the line.

Architectural Societies.

ARCHITECTURAL ASSOCIATION. — The proposed week-end visit to Chichester, announced in our "Meetings" column last week, did not take place owing to the want of a sufficient number of entries.

Correspondence.

REASON AND TRADITION.

SIR,—May I make a few belated notes which have occurred to me with reference to your interesting articles on "Reason and Tradition"? It has seemed to me that certain of the arguments put forward on behalf of reason apply to the architecture of Greece and Rome equally with that of mediæval Europe. Tradition unchecked and reason paramount appear rather to figure in all three, and never has any one of them been bound by rigid formulæ.

I am sometimes tempted to think of all architecture as Classic until the Renaissance made itself felt. The "great divide" seems most to lie in the fact that architecture previous to the Renaissance was unconscious, and afterwards it was not. When I have stood in Florence within the Church of Santo Spirito or before the Ruccellai Palace I have been immediately aware of some new element for the first time ranging itself alongside of tradition. I recognise an intruding personal force in the design, and often something that I can speak of only as sheer invention. The forms might doubtless be traced back to a traditional base, but they compel you to accept them on their merits. The sacristy of San Lorenzo presents a more notable instance still. As the late Charles Garnier said, "Michelangelo made his architecture."

I recall, also, an address you once gave, in which you cited examples of the daring with which individual designs had treated detail popularly supposed to be inviolate. This visible human element was, of course, no new thing. One cannot conceive of architecture existing without it. Yet it had previously presented itself, as it seems to me, in what I may venture to call a "soluble" form—saturating tradition, while the Renaissance crystallised this into the personal.

We cannot now return to the unconscious days of innocence did we desire it. The very effort to do so would betray our self-consciousness. To lead "the simple life" we must be simple people, and this must be also the first step towards reasonable architecture. Our materials cannot teach us to be that, though they will willingly assist us. Neither can tradition be clipped like a yew hedge. To learn resource from it here, and restraint there, and freedom everywhere offers greater opportunities, as I think, towards the formation of a national architecture, though the growth be slow, than can be hoped for by establishing an aristocracy of style drawn from one source or the other, and, if I am not mistaken, the evidences of such a natural growth are apparent to-day.

C. J. T.

ESTIMATING FOR EXCAVATION AND CONCRETE WORK.

SIR,—In your issue of September 15, under the "Builders' and Contractors' Column," you give two examples of estimating for a cubic yard of concrete; but I am at a loss to understand why you divide by 6 in the second example, as, inasmuch as you have added 15 per cent. for shrinkage, should not the division be by 7? Again, if you assume that the 7 yds. of dry material have shrunk 15-100ths, the amount to add to bring up to its original amount will be 1-5·66th of the balance of 85-100ths; also, I notice, you have added the 15 per cent. on to the labour, which, I think, is not usual, 1s. 6d. being a fair allowance for mixing and depositing a cubic yard of concrete when set in the work.

The method adopted by the writer, working on your prices, would be as follows:—

		s.	d.
6 yds. ballast 6s.	=	36	0
1 yd. cement	=	32	11
7		68	11
Shrinkage, 15 per cent. = add $\frac{1}{6.66}$		12	2
Divide by 7		81	1
		11	7
Add labour, etc.		1	6
		13	1
10 per cent. profit		1	4
As against your 16s. 5d.		14	5

The statement that a ton of cement is actually only 1-12th of a cubic yard is, of course, a misprint. It will naturally depend upon the weight of the cement, which varies, the average being about 100 lb. to the cubic foot, equals $\frac{100 \times 27}{2240}$, say, 1 1-10th tons to the cubic yard.

The writer has found, by repeated actual experiment, that concrete material, composed of two parts broken granite 1½ in., one part granite dust, one part sharp red sand, one part Portland cement, all by measure, when dry will shrink as much as 32 per cent. when set in the work, and, generally speaking, the finer the material and the more cement used the greater the shrinkage.

Perhaps some of your other contributors will give your readers the value of their experience, which, I feel sure, would be of interest to many beside myself.

HARRY A. DIX, A.M.I.C.E.

Leicester.

*** The "one-twelfth" should have been "eleven-twelfths." It was written in figures in the "copy," not in words, hence the printer's mistake, which we regret not having noticed.—ED.

BOOKS RECEIVED.

BUILDING CONSTRUCTION AND DRAWING: ELEMENTARY COURSE. By Charles F. Mitchell. Seventh Edition, revised. (B. T. Batsford. 3s.)

THE EDUCATION OF AN ARTIST. By C. Lewis Hind. (Adam & Charles Black. 7s. 6d.)

BUILDING CONSTRUCTION (ADVANCED AND HONOURS COURSES). By Charles F. Mitchell. Fifth Edition. (B. T. Batsford. 5s. 6d.)

Fifty Years Ago.

FROM THE *Builder* OF SEPTEMBER 20, 1856.

CESSPOOLS IN PARIS AND LONDON.—Paris, to the eye, is a very clean city: London, judged by sight alone, is very dirty. We must, however, again refer to the returns of the Registrar-General for practical results; and then we find that, although the metropolis of Great Britain numbers more than double the population of Paris—though we have a damp, dull-looking, smoke-laden atmosphere, and a foul river—we nevertheless have a lower rate of mortality. There must be reasons for such a result, if we can find them. Let us examine one set of works, and analyse the regulations under which they are used, striving to see if anything useful can be learned. The River Seine is not contaminated by sewage as the River Thames is, although there would be no tidal return and oscillation. The buildings of Paris do not drain into sewers, but the whole of the house-soil and slop refuse is passed into *pseudo*-hermetically-closed cesspools. These cesspools are constructed under regulations, and the superintendence of the municipal body or their officers. They are also emptied by the same authorities, and a very large return is obtained by sale of the manure after it has been deodorised. The system is considered perfect by its supporters: it has been lauded by public writers; and those who only judge from surface appearances conscientiously think the Paris plan of cesspool sewerage should be imitated. But these gentlemen have probably never lived long in Paris; or if they have resided there, it has not occurred to them that the sharp and subtle stench now and then met with can have anything to do with the cesspools; neither are they conscious that such a stream of gas may be more deadly than a wound by a naked sword. The French pay a terrible penalty for their cesspool system. Their clear atmosphere and clean river do not save them from the subtle, unseen, but most deadly gases of decomposition. This cesspool taint must have something electric in it, as it pervades all available space. On a bright warm day the doors and windows of a house may stand open from morn to night without bringing relief: it is not to be blown out. The boasted hermetical sealing is only a delusion and a snare. Fermentation takes place, and the gases of decomposition force a passage through every chink and cranny, as also back along the pipes and ducts which convey the refuse. There is no such thing as a "stench-trap" in existence, nor ever will be. As previously stated, the Paris cesspools are emptied by servants of the municipal body, and no doubt many persons consider that to empty a cesspool is, for a time, to remove the cause of contamination. This, however, is not so. The sides of a cesspool are foul from infiltration, the bottom is never entirely cleared from sediment, and there is soon a covering of liquid, so that there is a larger area of decomposition, and more cubical space for the deadly gases generated. A cesspool must be a foul abomination, if near a human dwelling, under any management. London is not without cesspools: there are thousands beneath dwelling-houses, and connected with them; but, fortunately, they never became municipal property. The small area covered by the City, and the defective powers of parish boards beyond City limits, have probably saved the English people from constructions so fatal to health and life. Better all the soil refuse of a city in the gutters, on the surface, or in the river, where the sun may dry it, the air ventilate it, the rain wash it, and the river dilute and remove it, than stored in cesspools, to undergo continuous fermentation and decomposition; but better still the instant removal of all soil and slop refuse (before decomposition commences), by means of drains and sewers, to some common outlet, where it can be applied at once to land for agricultural purposes. To obtain such results will be worth almost any pecuniary cost, supposing the whole outlay to be a loss; but, like all true improvements, such plan is the most economical.

"MOTTOES ON MANTELPIECES."—The last line of the inscription over the fireplace at Aston Hall should have run:—"To serve doe not disdaine" instead of "does" as printed.

Illustrations.

ORGAN, CHELTENHAM COLLEGE CHAPEL.

THE new organ, built in the west gallery of the chapel, is a large instrument, measuring 27 ft. across by 12 ft. 6 in. deep, and is 41 ft. high. It is by Messrs. Norman & Beard, of Norwich and London.

The case, which is a memorial to the late Dr. Dyer, is of English oak, and was carried out by Messrs. R. L. Boulton & Sons, of Cheltenham, from the design of Mr. H. A. Prothero (Messrs. Prothero & Phillott), Cheltenham.

COMPETITION DESIGN FOR THE PALACE OF PEACE AT THE HAGUE.

THIS design, in a Greek-Renaissance style of architecture, is intended to illustrate the international and world-wide purpose of the institution.

The main idea finds expression in the circular form of the plan, presenting to all nations from every side an equally dignified façade.

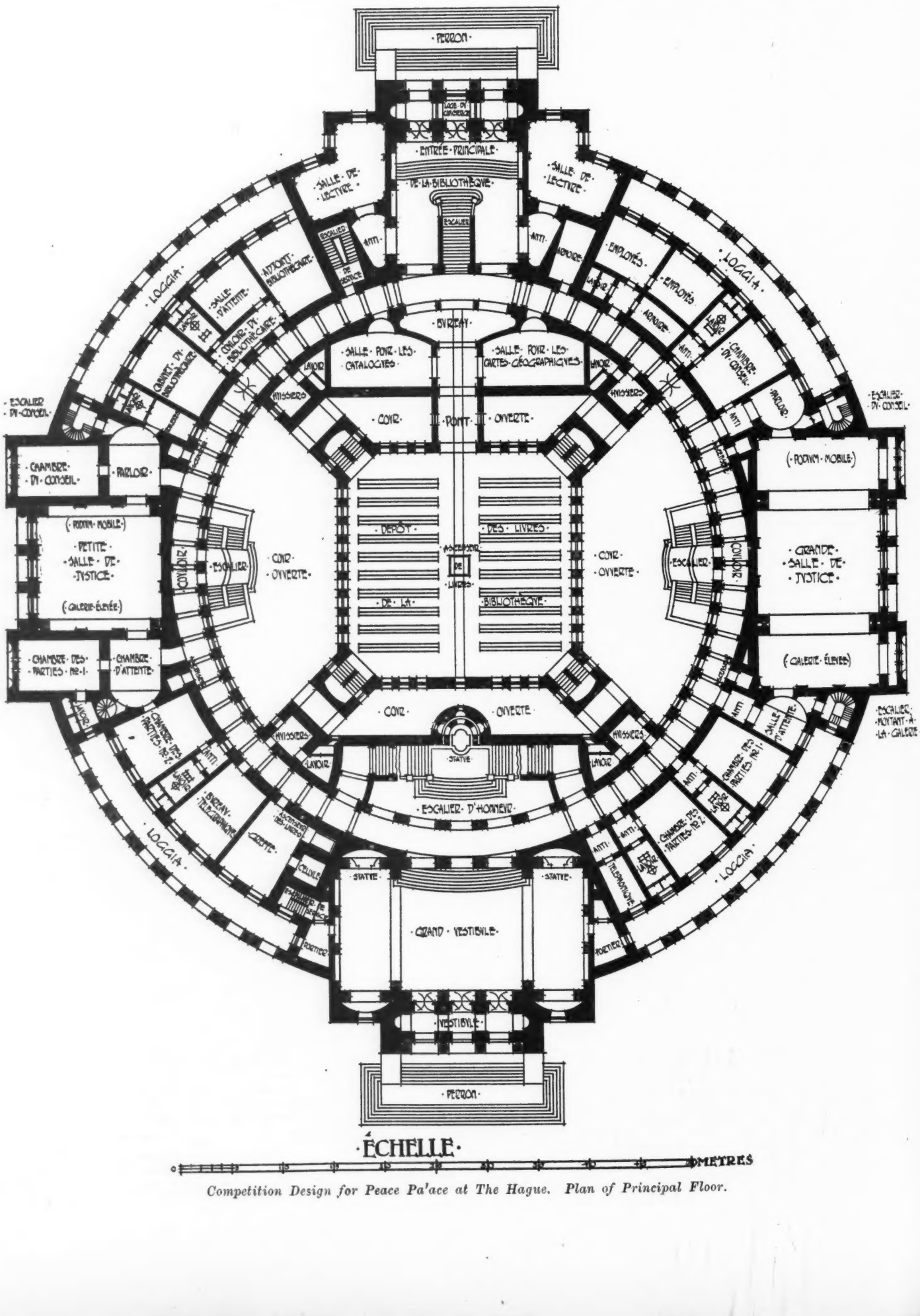
The books of the library are stored in a separate building in the centre of the Palace, and, though isolated from it by open courtyards, access is obtained by means of a bridge and circular corridors.

The perspective view was executed by Mr. H. F. Waring, and valuable assistance was rendered by Mr. J. F. Watkins in the preparation of the drawings

G. A. BLIGH LIVESAY.

CITY CHAMBERS, LEEDS.

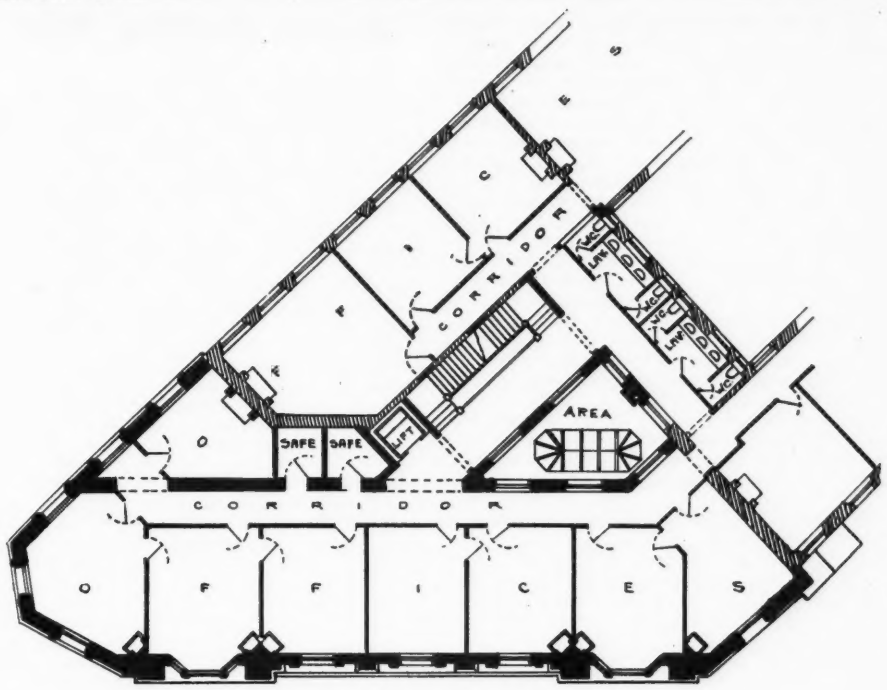
THESE premises are in course of erection upon one of the very best sites in the city, at the junction of East-parade, Bond-street, and Infirmary-street, the frontage line having been set back about 30 ft. Between the old and new buildings there was a street 12 ft. wide, which has been abandoned. The ground floor will be occupied by insurance offices, and the upper floors by professional men. The front is in Doulton's Carrara, and the floors are being erected on the Kahn system of reinforced concrete.



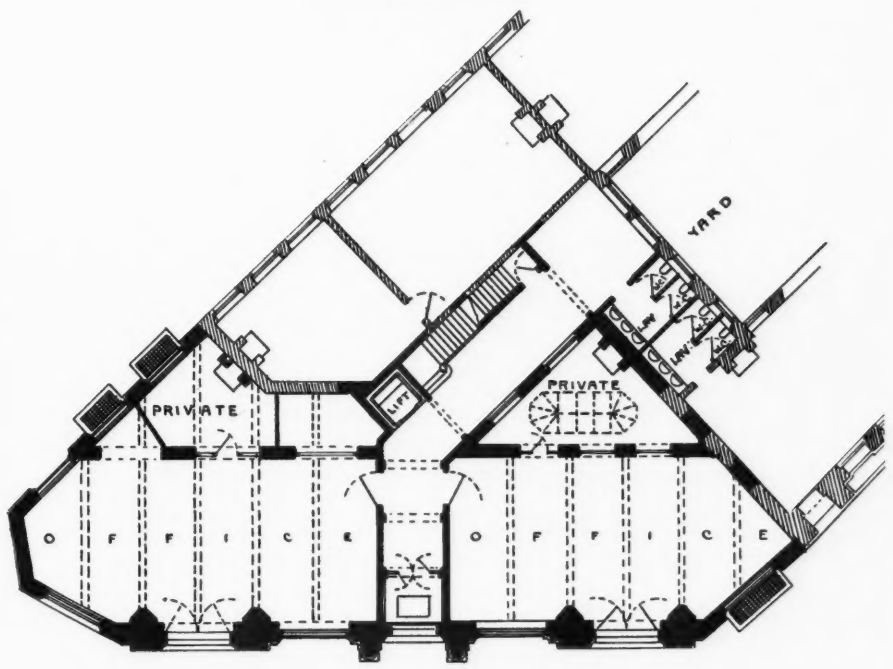
·ÉCHELLE·

0 METRES

Competition Design for Peace Pa'ace at The Hague. Plan of Principal Floor.



— FIRST FLOOR PLAN —



— GROUND FLOOR PLAN —

Scale of 10 5 0 10 20 30 40 50 Feet

City Chambers, Leeds. Plans.

The architects are Messrs. Perkin & Bulmer, of Leeds, whose drawing was exhibited in this year's Royal Academy exhibition.

NEW FONT COVER, WALSHAM-LE-WILLOWS CHURCH, SUFFOLK.

THE font cover herewith illustrated has been designed in harmony with the existing XVth century font in the above church. The cover is a fixed one of oak in three stages, all of which are octagonal in plan, and the lowest stage is arranged to open outwards for the baptismal services.

The middle stage is surmounted by a crocketed spire crowned by a finial of the pelican in her piety. The whole cover is being carved by a class composed of the village lads. The font at present stands upon the floor of the church, without steps, but it is proposed to provide stone steps as shown in the drawing. The whole work is being carried out from the designs and under the superintendence of the architect, Mr. W. G. Horseman, of London. The drawing was exhibited this year at the Royal Academy.

FONT-COVER COUNTERPOISE WEIGHTS, LOUGHBOROUGH CHURCH.

THIS wrought-iron work was designed by Mr. W. Samuel Weatherley, and incorporated an old XVIIth-century bracket, which was repaired and strengthened. Mr. Page, art metal-worker, of Loughborough, carried out the work. The drawing was exhibited in this year's Royal Academy.

METROPOLITAN ASYLUMS BOARD.

THE usual fortnightly meeting of the Managers was held at the offices, Victoria-embankment, on Saturday, September 15, Mr. C. M. Martineau in the chair.

Correspondence.—A letter was received from the Local Government Board asking the Managers to reconsider their proposal for the erection of a porter's lodge and staff cottages at Joyce Green Hospital, with a view to reducing the cost of the scheme.

Darenth Asylum.—The Works Committee reported that on the 14th inst. they accepted two tenders for laundry alterations at the Darenth Asylum, viz., that of Mr. T. Knight, Sidcup, for building works at the sum of 1,016*l.*, and that of Messrs. D. & J. Tullis, Southwark Bridge-buildings, for engineering work at 2,885*l.* When asked to sign their respective contracts on the 10th inst., Mr. Knight declined, as he said he had made serious errors in his totals, the items amounting in all to 382*l.* 3s. 8d. He asked permission either to withdraw his tender or do the work for 1,316*l.* 3s. 8d., which was his original tender, 1,016*l.*, plus 382*l.* 3s. 8d.; but he subsequently agreed to reduce that item to 300*l.* 3s. 8d. The Committee had satisfied themselves that Mr. Knight had made a *bonâ-fide* error in his tender. It would be remembered that the next lowest tender was that of Messrs. J. Ellingham & Sons, Dartford, at the sum of 1,693*l.*

They therefore recommended that Mr. Knight's tender for laundry alterations at Darenth Asylum at the increased amount of 1,316*l.* 3s. 8d. be approved and adopted.

Mr. Elliott and Mr. Lyall protested against the alteration being made, as it laid the Board open to abuse in matters of such kind.

Mr. Thornley, in reply, said that they, as a Board, did not want to be unfair to anyone, and as the Committee had reported they had gone into the matter, and were of opinion that a *bonâ-fide* error had been made, he considered that, in fairness, they should accept the explanation.

The recommendation of the Committee was adopted.

HOUSING OF THE WORKING CLASSES IN MIDDLESEX.

IN the annual Report of Dr. Young, the Medical Officer of Health for the County of Middlesex, recently issued, he says, referring to the Housing of the Working Classes Act, that remarks are made in the reports of the local medical officers of health and sanitary inspectors in the county to the following effect:—In Brentford, Dr. Bott states that the "housing question" has always been a difficulty owing to proximity to London and the large number of workmen engaged in the town. He thinks the extension of tramways and cheapening of railway communication should induce workmen to go further afield. He also advocates the widening of the High-street because all the old and bad property in the town is in its vicinity, and if the street were widened to 80 ft. this property would have to be pulled down. In the Chiswick report reference is made to two schemes which were mentioned in last year's Report. In the case of one of these it is stated that the houses have been thoroughly repaired and are now in a habitable condition. The other scheme, known as Strand-on-the-Green, has not yet been dealt with. In Edmonton it was decided that, in order to carry out by-law No. 113 made by the District Council as regards new streets and buildings (which requires that no new dwelling-house shall be let or occupied until it has been certified after examination by an officer of the Council to be fit for human habitation), the Medical Officer of Health should give this certificate. All new houses were therefore visited by him. Certificates were granted after the first inspection in 234 cases, and after a second inspection in thirty cases. In one case a conviction and penalty was obtained against an owner who allowed his houses to be occupied before receiving this certificate. Closing orders under the Housing of the Working Classes Act were obtained in respect to three houses, and notices were served as regards two which were not fit for human habitation. In Finchley the inspector reports that, owing to failure of an owner of seven houses to carry out requirements of the authority, the works were executed by the district Council, and the cost recovered. In the report on Hayes Urban District, Dr. Higginson states that cottage accommodation is rapidly becoming more adequate; previously such has been much needed. Dr. Fletcher Little, in his report on Harrow, sets out some suggestions for the amendment of the existing by-laws. In the report on the district of Heston and Iselworth, Dr. Steegmann directs attention to the advantages of the system now in force, whereby, before a certificate is given as regards the fitness of a new house for habitation, the drains are tested by an official of the Public Health Department in conjunction with the Surveyors' Department. For the newly-created Urban District of Ruislip Northwood, new by-laws relating to streets and buildings were being framed. Dr. Ransome again repeats his remarks as to the necessity of providing suitable dwellings under the Housing of the Working Classes Act for working men in the district of Southgate. Dr. Gunther, in his report on Teddington, advises the District Council to consider the question of providing suitable cottage dwellings for the working classes in view of the fact that available sites are getting scarce and more expensive. In Tottenham twelve houses were closed as being

unfit for human habitation. The estate which is being developed by the London County Council progressed rapidly during the year, and it appears that within eighteen months it is anticipated that houses for an additional 5,000 persons will be completed. Other houses are also being erected by the Governors of the Peabody Donation Fund. In the case of Wealdstone Dr. Butler draws attention to the bad construction of some of the flats in the poorer parts of the district. He especially mentions Canning-villas; these, he states, were the subject of a special report in the previous year, but nothing appears to have yet been done, and he reports that, in his opinion, they are not fit for human habitation in their present condition.

THE ROTHERHITHE TUNNEL.

THE members of the Society of Engineers, on Wednesday, the 19th inst., paid a visit to the works of the Rotherhithe Tunnel, now in progress, of which the following is a description:—

The work, which is being carried out by the London County Council, consists of a carriage and footway tunnel, with approaches, commencing in Lower-road, Rotherhithe, and terminating in Commercial-road, Stepney. The total length is 6,883 ft., of which 2,020 ft. is open approach, 1,122 ft. cut and cover, and the remainder, 3,741 ft., tunnel, lined with cast-iron and concrete. There are four vertical shafts. One on each bank of the river near the water's edge, and one at each end of the iron-lined tunnel further inland. These shafts vary from 70 ft. to 100 ft. in depth; they are each 50 ft. diameter inside, the sides consisting of two steel skins, 5 ft. apart, with the intervening space filled with concrete. Openings are provided in the shafts for the tunnel; these openings are temporarily closed while the shafts are being sunk, and until the tunnel is connected up with them. The under-river portion of the tunnel is about 1,500 ft. long between shafts, and crosses the river diagonally in order to clear the entrances to the Surrey Commercial and the London and India Docks, which lie opposite each other at this point of the river.

The tunnel proper is circular in section, the outside diameter of the cast-iron lining being 30 ft., with a thickness of metal of 2 in. under the river, and 1¾ in. elsewhere. The lining is put together in rings each 2 ft. 6 in. wide, and composed of sixteen segments, with a key-piece. The rings are bolted together by means of bolts through the internal flanges which have a depth of 14 in. These flanges will be hidden when the work is completed by the concrete lining, which will have an internal diameter of 27 ft. The faces of the iron at the joints are all machined for a width of 12 in., and the segments fit metal to metal. The remaining 2 in. at the internal edge of the flanges are recessed for caulking with lead and rust cement.

The tunnel is being constructed by the shield system under compressed air. A small pilot tunnel, 12 ft. 6 in. external diameter, was first driven across the river, and it is being followed by the main tunnel. The strata met with are known as the Woolwich and Reading beds, and consist chiefly of clay with beds of sand and shells, overlying a bed of marl or rock of a chalky nature. Below the last occur a compact bed of pebbles, and a thick bed of sand.

The cut and cover portion of the work consists of a brick barrel, 1 ft. 10½ in. thick, surrounded with concrete. The internal diameter of the brickwork is 27 ft., the same as in the case of the concrete lining in the iron tunnel. The surface of the roadway will be 5 ft. below the axis of the tunnel in order to obtain full advantage of the available width. This will allow of a 16-ft. carriage-way and two 4-ft. 8½-in. footpaths. Below the roadway the section provides for a subway which can be used for gas and water mains, electric cables, etc.

In the case of the open approach the section consists of concrete retaining walls with battering face, surmounted by a brick parapet. A concrete invert fills the space between the footings of the side walls, and upon this the roadway is to be placed. The tunnel faces on each side of the river are built of red Aberdeen granite surmounted with a massive granite parapet, the surface of the whole being polished. Both the cut and cover portion of the tunnel and the open approaches are made water-tight with asphalt. At one point, viz., on the south side of the river, the tunnel approach crosses the East London Railway. The crossing occurs at the Rotherhithe station, and it has been necessary to cut away a portion of the railway tunnel, build new retaining walls, and carry the new roadway across the station platforms and the rails by means of a girder bridge. At the present time the approaches and cut and cover portion on the south side of the river are nearly completed. All the shafts have been sunk, and the tunnel has been driven rather more than half-way across the river. On the north side of the river the open approach and cut and cover portion of the work are in progress. An extensive plant for air compressing and hydraulic purposes has been installed, including six air compressors capable together of dealing with 1,000,000 cubic ft. of air per hour. About half that quantity is at present being delivered into the tunnel. The contract was let to Messrs. Price & Reeves early in 1904, and the work is expected to be completed in 1909. The cost of the work will be about 1,000,000*l.*

The Engineer-in-Chief is Mr. Maurice Fitzmaurice, Chief Engineer to the London County Council, the resident engineers being Mr. E. H. Tabor, assisted by Mr. A. G. Drury, member of Council of the Society of Engineers, by the latter of whom the visitors were received and conducted over the works.

ROWNTREE'S SYSTEM OF REINFORCED CONCRETE.

THE latest novelty in the way of concrete-steel is the "improved method" suggested by Messrs. Rowntree, of York, the well-known manufacturers of cocoa and chocolate. As it may be thought that proficiency in the production of such delicacies is a doubtful qualification for architectural construction, we ought to explain that the new system emanates from the building department established by the firm at their works—presumably for the execution of repairs and the erection of additional buildings.

From drawings we have receievd it would appear that Messrs. Rowntree's method is intended as an improvement upon the Hennebique system, for it includes all the essential features of that system, and so far is sound. It embodies additional features, of which some are good in theory but inadvisable in practice, while others are apparently based upon inaccurate views as to the distribution of stresses in structural members.

The chief novelties in the first category are (1) a new form of patent bar with slightly extended surface, which, compared with a plain round bar of equal cross-sectional area, offers a greater surface for adhesion of the concrete, and increased resistance to flexure; (2) a form of stirrup with eight complete twists in the metal for the purpose of securing increased resistance to shear; and (3) the disposition of the stirrups in an inclined direction. The new type of bar suggested is open to the objection, applying to all patented devices of the kind, that any theoretical advantage promised is counterbalanced by the extra cost of specially-rolled sections, and the inconvenience and delays that usually follow the employment of materials not obtainable in the open market. The saving of metal that might be effected by the use of twisted stirrups would be a very small item compared with the labour involved in the operation of twisting, and in the advance preparation, storage, and correct allocation on the site of "purpose-made" stirrups, instead of equivalent members simply cut from a length of steel strip and bent to form as required. The inclination of the stirrups is an old idea which has been largely applied in the United States and on the Continent for many years past, and the only novelty in Messrs. Rowntree's arrangement is that the angle of 60 deg. has been substituted for the correct angle of 45 deg. There are, however, two practical objections to inclined stirrups. One is that a horizontal bearing for the longitudinal reinforcement cannot be obtained unless the bottom loop of the stirrup is forged at a suitable angle, and the other is the difficulty of ramming concrete in a satisfactory manner between and around the loops of the stirrup without disturbing its position.

In the second category of new features are curved "stiffeners" for the compression areas between the points of contrary flexure in the adjoining spans of a continuous beam, and inclined stiffeners for the compression area of a column base. These "improvements" would be essential if the areas in question were subject to tension, but only represent waste of material when applied in areas of concrete already adequate for the resistance of compressive stresses. Moreover, the beam stiffeners shown on the drawings are of the wrong form, because they follow a curve that is diametrically opposite to that indicated by the outline of the diagram of bending moments.

So far as concerns concrete-steel Messrs. Rowntree & Co. have evolved a system which cannot be recommended as it stands. If suitably modified and applied by a designer of experience, it might be adopted without risk, but even then would lead to unnecessarily costly construction.

General Building News.

CHURCH, HELLIFIELD.—On the 15th inst. the Bishop of Ripon dedicated the new church of St. Aidan, which has been erected to serve the needs of the Hellifield portion of the parish of Long Preston. The total cost is about 3,500*l.* The church consists of a nave and chancel, which will accommodate about 250 worshippers. There are also a clergy vestry and a parochial room. The tower is 55 ft. high, and is capable of holding a peal of bells. The walling is of rubble in mortar, and the furnishings are principally of oak. The architects were Messrs. Connon & Chorley, of Leeds.

WESLEYAN CHAPEL, BROCKHOLES.—A new Wesleyan chapel has been built in this village. The chapel will accommodate about 200 persons. It contains nave, chancel, minister's vestry, organ-chamber, and stone porch, with arched opening, enriched with mouldings, and carved patteræ. There is also a vestry or dorcas-room under the front portion of the church. The outer walls of the church are faced with hammer-dressed local stone in random course, pointed in Portland cement, and having buttresses with dressed stone weatherings. The chancel arch is of dressed ashlar, with double-splayed jambs and drop arch, and the floors of the chancel and main aisles are of cement-concrete, stained to the colour of red tiles. The chancel ceiling is barrel-vaulted in plaster, with moulded ribs and modelled patteræ. The communion rail and pulpit are in oak, the seating and open-timbered nave roof in pitch-pine, the latter unvarnished. The building has been erected from the plans and under the supervision of Mr. E. W. Lockwood, architect, Huddersfield; and the following were the contractors:—Mason, Mr. Robert Turner, Holmfirth; joiners, Messrs. J. & J. Shaw, Holmfirth; slaters, Messrs. Pickles Bros., Huddersfield; plasterer, Mr. T. B. Tunnicliffe, Huddersfield; plumber, Mr. J. Kenyon, Holmfirth; hot water, Mr. Rayner, Holmfirth; painters, Messrs. Spence & Co., Honley.

WESLEYAN CHAPEL, THORPE HESLEY.—The foundation-stones of a new Wesleyan Methodist chapel were laid at Thorpe Hesley, on the 13th inst. The new building will comprise a church to accommodate 350, an organ-chamber, end gallery, approached from the front by means of a staircase, and main entrance. There is to be one large vestry. The front and staircase of the church will be faced with sandstock bricks, with local stone dressings. The roof will be partially open, and the windows will be glazed with ornamental leaded lights. The building will be heated on the low-pressure system. The contractor is Mr. J. Cooper, of Rotherham. The design is that of Mr. A. E. Lambert, of Nottingham, whose work was accepted in open competition. The cost will be about 2,000*l.*

METHODIST CHAPEL, HULL.—The erection of a new chapel for the Methodist New Connexion body at Hull has just been commenced. The building will face the Boulevard, and is from designs by Mr. W. H. Bingley, of Whitefriargate. The contractor is Mr. Sanderson, of Hull, and the cost, exclusive of land, will be 2,505*l.*

WESLEYAN METHODIST CHAPEL, SOUTH ELLESMERE.—The foundation-stones were laid recently of a new Wesleyan Methodist Chapel, which is being built at South Ellesmere. The building is being erected in King-street, and it will accommodate about 250 persons. The cost, including the land, will be about 1,000*l.* The church is designed after the Gothic style, the architects being Messrs. J. H. Davies & Sons, Chester.

SCHOOL ENLARGEMENT, MIDDLESBROUGH.—The Middlesbrough High School has recently been enlarged by the addition of a west wing. The new wing provides accommodation for 240 pupils, and, with the exception of the studio and music rooms on the second floor of the south wing, is arranged on two floors. The principal entrance is at the King Edward's-road front of the buildings, and another entrance is provided into the playground at the Clarendon-road front of the school. On the ground floor are porch and hall at the north and south end of the school with staircase adjacent giving access to the upper floor. Adjoining the main entrance a waiting-room and head mistress's rooms are provided. The main feature of the ground floor is the assembly-hall, 60 ft. by 31 ft. 3 in., with a platform at one end. In addition, on this floor, are four classrooms, cloak-rooms, and lavatories for the pupils. The first floor has six classrooms, students'-room, and assistant mistress's-room, store-rooms, and lavatories, a corridor giving access to the classrooms. The second floor contains studio, 33 ft. by 24 ft., and two music classrooms. Mistresses' cloak-rooms and store-room are provided on

Mezzanine floor. There are also cellars for heating apparatus, coal storage, etc. Laboratory accommodation is provided in a separate building on the southern extremity of the site, with a frontage to Clarendon-road, and includes laboratory, fitted up for physics and chemistry, lecture theatre, dark-room, and store. The staircase and the whole of the first floor are of fireproof construction. In addition to windows, which are provided with beads to allow of air inlets at meting rail level, and hoppers to upper sashes, air-outlet flues are provided from the ground-floor rooms, and Cousland & Mackay's concealed roof ventilators are used for extracting purposes to rooms on upper floors. Each room is provided with a fireplace, in which is fitted Shoreland's Ventilating Stove. The principal heating is by low-pressure hot-water. The interior woodwork (with the exception of the main entrance porch, which is in oak) has been carried out in pitch-pine, and stained green. The floors are laid with maple blocks. Electric light is fitted throughout the buildings. The elevations are faced with red pressed bricks, and have Dunhouse stone dressings, and the roof is covered with dark Lancashire slates. The total cost of the work was about 10,000*l*. The principal contractor was Mr. Geo. M. Radge, Normanby, whilst the following were the sub-contractors:—Joinering, Messrs. W. A. King & Son, Ltd., North Ormesby; plumbing, Mr. T. B. Watson, Stockton-on-Tees; slating, Mr. W. B. Robinson; painting, Messrs. W. L. Taylor & Son; plastering, Messrs. Smiles & Dawson; carving, Mr. A. J. Arrowsmith, London; electric lighting and heating, Messrs. Baker Bros.; asphalting, Mr. David Mullen; hardware, Messrs. N. F. Ramsey & Bros., Newcastle-on-Tyne; constructional ironwork, Messrs. Dorman, Long, & Co. Mr. J. G. Duckworth has acted as clerk of works, and Mr. Cecil E. Lugard as electrical engineer. The whole of the work has been carried out from the designs of Mr. T. A. Lofthouse, of the firm of Messrs. R. Lofthouse & Sons, architects, Middlesbrough.

PROPOSED ART SCHOOL, EDINBURGH.—A meeting of the sub-committee of the Provisional Committee, which has under consideration the proposed new art school for Edinburgh, was held on the 12th inst., in the City-chambers. Lord Provost Sir Robert Cranston presided, and among those present were Mr. Pittendrigh Macgillivray, R.S.A.; Mr. Kinross, A.R.S.A.; and Mr. Morham, City Architect. The principal object of the meeting was the consideration of a set of plans for the new school, prepared by Mr. Macgillivray and Mr. Morham, with the view of embodying, as far as possible, various suggestions made by the members of Committee. The plans, it is understood, were found to be satisfactory, though they show that, if adopted, a larger area than that originally regarded as likely to be sufficient will be required. The meeting was adjourned for a week, by which time the Committee hope to have before them such information as will satisfy them as to the minimum accommodation which should be provided.

SYNAGOGUE, HIGHER BROUGHTON, MANCHESTER.—The new synagogue, about to be erected by the Higher Broughton congregation, will occupy the garden ground at the corner of Broughton-road and Duncan-street. It will have accommodation for about 400 persons. The main entrance, from Duncan-street, will have the main staircase (to the gallery above set apart for the ladies of the congregation) enclosed in an octagonal tower. The ark, reading platform, and pulpit will be arranged at the eastern end of the building, with the choir behind. A dome in ferro-concrete will surmount the octagonal tower, and the main vestibule will be arcaded. The designs for the building have been made by Mr. Delissa Joseph, architect, of London.

PROPOSED CRICKET PAVILION, THIRSK.—The Thirsk Cricket Club Commiteee have under consideration the erection of a new pavilion on their ground. Mr. Stokes, architect, has been appointed to prepare sketch plans and give estimates of the proposed work.

POLICE-STATION, LONGTON.—The new police-station, at Longton, has been erected by Messrs. Tomkinson & Betteley, at a cost of about 7,000*l*. The designs were by Mr. W. H. Cheadle, County Surveyor, and Mr. A. R. Wood, Tunstall. The frontage to Sutherland-road is of red brick, with light buff terra-cotta facings. Excavations were in some places of considerable depth, and a foundation of concrete was placed over the clay surface. A dwelling-house for the superintendent forms the southerly end of the block, and the other accommodation of the buildings consists of a suite of offices, cells, and exercise yard, living and sleeping quarters for the single constables, the necessary outbuildings, and a large open area as a drill-ground. Mr. Kearton, Wolstanton, has been clerk of the works. Mr. Durose, Tunstall, fixed the iron palisading at the front, and executed the ornamental ironwork; Messrs. Blackburn & Starling, Hanley, installed the electric bells, tubes, etc.; and Mr. Trusswell, of Newcastle, fixed the heating apparatus.

PROPOSED PIER, FLEETWOOD.—It is proposed to erect a pier at Fleetwood. The situation chosen for the new structure by the promoters of the scheme is opposite Balmoral-terrace. The pier is to be 700 ft. long, inclusive of a timber jetty 200 ft. long and 15 ft. wide, which will have its terminus in water at all states of the tide. The entire structure will be on piles, with screw piles where necessary, the girders being of toughened steel, with Jarrow wood planking and ornamental seating and railing. The first length of the pier, including the pavilion, will be 247 ft., varying in width from 120 ft. to 25 ft. The second length of 253 ft. will have a width of 25 ft. throughout, and the third section is the timber jetty. The elevation of the jetty will be 12 ft. vertically below the main deck of the pier proper, which will be on a level with the existing promenade. The entrance to the pier will be located 24 ft. away from the line of the promenade, and will consist of pay-boxes on two sides, with a main covered way of 15 ft. in width, over which will be store-rooms for the use of the pier generally. On the left of the approach the manager's office will be arranged, and on the right a series of cloak-rooms; while outside these two buildings, on either side, will be exit gates, making a total width over offices and main entrance of 52 ft. The pavilion has been designed to be situated within 68 ft. of the promenade. It will have seating accommodation in the body of the hall for 1,100, and in the two side galleries for 300. The whole will be constructed of timber, with glass, lead, and zinc roof, with closing verandas. Arrangements will be made for electric and gas lighting. Mr. J. E. Stafford, C.E., is the engineer of the scheme.

THEATRE, MANSFIELD.—The new Grand Theatre at Mansfield has just been opened. Externally, the building is of brick, with stone dressings. The stage is 40 ft. long by 65 ft. wide, the height being 50 ft. Four dressing-rooms, the width of the stage, are provided, and there are extra rooms underneath. The building will accommodate about 1,240. The stalls will take 120 persons, the dress circle 120, the upper circle 400, and the gallery 600. Each section of the house has two exits, and there are also separate entrances. The lighting is by electricity, and the heating by hot-water radiators. The theatre was built by Mr. A. F. Houfton, of Mansfield, from the designs of Mr. T. V. Woodhouse, architect, of Nottingham.

Sanitary and Engineering News.

LEEDS WATER SUPPLY.—It is announced that the City Council of Leeds have decided to proceed with an extensive scheme, based upon reports framed by Mr. C. G. Henzell, the City Water Engineer, jointly with Mr. Rofe, the consulting engineer, and by Messrs. H. Rofe & Son, of Westminster. The modified project involves a departure from the plans as originally adopted under the Act of 1901 for a reservoir at Colsterdale, in the Burn valley, to extend over 107 acres, with a capacity of 1.852 million gallons. It has been discovered that the site selected does not afford a good foundation for the retaining wall; another site has therefore been chosen, higher up the valley, for a reservoir to be embanked with a dam 15¼ chains long across the river Burn, for which, and for accessory works, fresh Parliamentary powers will be sought. When the Carlesmoor and Laverton reservoirs in the Laver valley and the Leighton reservoir in the Burn valley are also completed, the total storage will amount to nearly 2,265 million gallons, and the cost of the entire undertaking, after allowance made for the large sums already expended, is estimated at some two millions sterling.

ELECTRICAL LIGHTING AND ENERGY, MARYLEBONE.—The Borough Council have resolved to charge consumers within the borough limits for a supply at 240 or 480 volts (*a*) for ordinary lighting purposes, 8d. per unit for a quantity equivalent to 500 hours' use of the maximum demand made for energy in each year, and 1d. per unit for all energy consumed in excess of that quantity during the said year; (*b*) through special circuits and meters for all purposes other than lighting, 2d. per unit for a quantity equivalent to 125 hours' use of the maximum demand made in each quarter, and 1d. per unit for all energy consumed in excess of that quantity during the said quarter; and to charge 2d. per unit consumed for current supplied by separate circuits and meters to basements not used for dwelling purposes. The meter rents will be at the rate of 10s. per annum for each fifty 8 candle-power (32 watt) lamps installed, or the equivalent in kilowatts or parts thereof, with additional rentals at those rates for separate meters required for special currents. A discount of 25 per cent. will be allowed, under conditions, on each quarter's account exceeding 50*l*., calculated upon the rates severally specified. The Council have, moreover, resolved to substitute arc lamps for the incandescent mantles in some of the lamps of the principal streets; the new installation will consist of five single arc lamps, six central arc lamps, and thirty-five arc lamp columns, each bearing two lamps, all the lamps being after the "flame" arc kind made by the Union Electric Company. The charge of 8d. per Board of Trade unit is an advance beyond that of 6d., or less, which was formerly made by the Metropolitan Company in Marylebone.

LOUGHBOROUGH WATERWORKS. — The new waterworks, for which Mr. Hodson was the engineer, were opened on September 12. The reservoirs at Black Brook, in Charnwood Forest, are equal to a supply for 60,000 persons, and the Town Council will sell the surplus (enough for 30,000) to Leicester, pending the completion, in about seven years' time, of the Derwent Valley supply system for that borough. The heavy cost, some 120,000*l*., of the Loughborough undertaking is due to difficulties presented by unexpected faults of the rock formation.

HARBOUR AND DOCK EXTENSIONS ON THE CLYDE AND THE FORTH.—The new works which are being carried out by the Clyde Navigation Trustees comprise a widening of the channel and harbour at Renfrew, with workshops and slips for the repair of dredging plant now being used at Blythswood and between Newshot Island and the River Cart; the removal of Pointhouse Wharf, and new timber wharves and cattle lairages at Merklands; and basins and quays at Yorkhill. The newly-completed wharf beyond Shieldhall, nearly 1,700 ft. long, is to be extended eastwards by about 430 ft. At Clydebank Dock are being constructed a culvert to divert Yoker Burn, a road by the side of the Lanarkshire and Dumbartonshire Railway, and dock sidings to meet a branch line to be laid by the North British and Caledonian Railway Companies. The walls of the dock will extend over a length of nearly 6,650 ft., and it is anticipated that the quay walls will be finished before the close of next year. The Harbour Commissioners for the Forth have granted to a syndicate a lease of 8 acres on the west side of the harbour at Burntisland for the construction of a dry dock and ship-repairing workshops, to serve the ports on the south coast of Fife.

MANCHESTER SHIP CANAL.—Under the directions of Mr. W. H. Hunter, the Company's chief engineer, steps have been taken to keep in the tidal water, concurrently with a deepening of the canal water by 2 ft. This has been effected by the laying of a 2-pipe siphon, 180 ft. long, across the bed of the canal at Frodsham Marsh, for conveying the Hoolpool Gutter stream, the Frodsham sewage, and the water from the low-lying lands, around which will thereby become more subject to floods. Each length of pipe is 6 ft. long, and has an inner diameter of 3 ft. 6 in.; the lengths are bound together and coated with cement 5 in. thick, enveloped with steel wire-netting. The siphon was towed down to its position from Big Field, Norton, eight miles distant, having its ends sealed, and being supported by three pontoons.

SUSPENSION BRIDGE, NOTTINGHAM.—The new footbridge over the River Trent between Trent Bridge and Wilford Bridge was recently opened. The bridge has a span of 225 ft. between centres of abutments, and is 12 ft. wide. Below the footway are two steel water mains, each 14 in. internal diameter, conveying water to and from the new reservoir on the top of Wilford Hill. The four cables, each constructed of 259 wires, are manufactured of the best plough steel. The ends of the cables on either side of the river are anchored to steel girders with adjustment arrangements, the girders being weighted by blocks of concrete. The cables pass over steel rockers on the tops of the abutments, these rockers being attached to steel girder frames built in the stone abutments. The ultimate strength of each cable is about 280 tons. The cables support, by means of fifty-eight suspension rods, the whole of the weight of the cross-girders, pipes, footway, etc. Two lines of 12 in. diameter gas pipes have also been laid across the bridge for use at any future time, and there is also provision for electric cables. The structure was designed by Mr. W. B. Bryan and Mr. F. B. Lewis, the City Architect, and constructed under the supervision of Mr. F. W.

Davies, the Water Engineer for the City. The contract for the foundations, abutments, and approaches was let to Mr. J. G. Thomas, of Lenton-boulevard, Nottingham, and the steelwork to Messrs. Handyside & Co., of Derby.

NEW WATERWORKS, BUNTINGFORD.—The well for the new waterworks has been completed by Mr. G. Hughes, of Westminster. It is 134 ft. deep, and is capable of yielding 10,000 gallons of water per hour. The cost of this first contract was 500*l*. For constructing the reservoir and laying some three miles of mains the District Council invited tenders, and some nineteen were received. That of Messrs. Grounds & Newton, of South Tottenham, was accepted for 3,167*l*. The work has to be completed within eight months. Mr. J. Chadwick, of Bletchley, is the engineer, and to him was due the scheme for the Hadham Waterworks.

THE LONDON COUNTY COUNCIL'S DRAINAGE BY-LAWS.—The Public Health Committee of St. Pancras Borough Council, in a Report issued on Monday, stated that they had had under consideration a communication from the London County Council, in reply to a letter from the Committee, in which it was pointed out, that, under No. 8 (4) of the drainage by-laws made by the County Council under sect. 202 of the Metropolis Management Act, 1855, sanitary inspectors were obliged to compel builders to put 4-in. ventilating pipes to 3½-in. soil pipes and 3-in. drain pipes allowed under by-laws Nos. 11 (2), 4 (9 and 10). The County Council, in their reply, called attention to the provision in No. 8 (6) of the by-laws, that, where the drain to be ventilated is not more than 4 in. in diameter a soil pipe or waste pipe containing excremental filth, although only 3½ in. in diameter, may be used as a ventilating pipe subject to certain conditions; and, further, that, in regard to the ventilation of drain pipes, the drain for which ventilation is primarily required is a drain containing sewage, which is required by by-law No. 4 to have an internal diameter of not less than 4 in. The Council stated that, under these circumstances, they had decided to take no action in the matter. The Committee had received the following report from their Medical Officer of Health (Dr. J. F. Sykes) on the subject:—

"Builders still continue to complain that they are allowed to put up a 3½-in. soil pipe and a 3½-in. vent pipe to ventilate a 4-in. drain, but that if they ventilate a 4-in. drain not having a soil pipe, but a branch water-closet drain on the same level, they are compelled to make a branch 4 in. diameter and the vent pipe 4 in. diameter. In other words, if the vertical vent pipe is the continuation of a 4-in. horizontal drain, it must be 4 in. in diameter; but if to this vertical vent pipe a water-closet is connected, it becomes a soil pipe, and may, together with the soil pipe, be reduced to 3½ in. in diameter. A soil pipe is a direct continuation and part of a drain, that portion which is horizontal being called drain, and that which is vertical being called soil pipe, so that a soil pipe is a vertical drain, and should be subject to similar provisions. The anomaly was typically apparent in the case of the teachers' house at All Saints' School, Pancras-street (see Plan No. 10,270), where your committee declined to take any action against the builder for putting up a 3½-in. ventilating pipe to the drain because the water-closet was on the basement level instead of the first floor. The continual irritation and annoyance caused by this anomaly is not experienced by the London County Council, but by the Borough Council, which is the executive authority, and I feel sure that the London County Council would rectify the wrong upon the representations of the sufferers if sufficient pressure were brought to bear. A great amount of confusion and complaining would be avoided if a minimum diameter of 4 in. were adopted for soil pipes in by-law 11, paragraphs 5 and 2, or if a minimum diameter of 3½ in. were adopted for drains in by-law 4, paragraphs 3, 9, and 10, and for vent pipes in by-laws 8, paragraph 4. One of these alternatives should be adopted."

A copy of the foregoing report of the medical officer is to be forwarded to the London County Council.

ELECTRICAL EXHIBITION, SHEFFIELD.—An exhibition of electrical machinery and appliances is being arranged at the Corn Exchange, Sheffield. It will be opened by the Lord Mayor at 3 p.m. on the 27th inst., and will remain open to the public daily from noon to 10 p.m. until October 20. A number of exhibits of peculiar interest to the local metallurgical and engineering industries have been secured, as well as a display of domestic and public lighting apparatus.

Stained Glass & Decoration.

MEMORIAL WINDOW, ATHELSTANEFORD, N.B.—A memorial window to the late Lady Kinloch, of Gilmerton, has been placed in Athelstaneford Parish Church. The window is the work of Mr. E. C. Kempe, London, and represents the Presentation of the Infant Christ in the Temple.

EMMANUEL CHURCH, SOUTHPORT.—Messrs. Percy Bacon & Bros. have just added some more stained-glass windows to this church, having executed six clearstory to light windows; the first two represepting Angels; the second two SS. Peter, James, John, and Andrew; the third two Isaiah, Jeremiah, Ezekiel, and Daniel.

Foreign.

GERMANY.—Professor Theodor Fischer, of Munich, who has lately been appointed to the Chair of Architecture in Stuttgart University, has influenced modern architecture in Munich to an unusual degree, and stamped it with his personality. His style, although individual, harks back to the simple work characteristic of the early local art. It is too devoid of ornament to appeal to the lay mind, but it is just this simplicity and the masterly way in which he handles it that makes him rank among the greatest artists of his country. In his Fangelsbach School, Stuttgart, opened last May, Fischer has developed the whole scheme of his artistic style, and shown how effect may be produced by a broad and simple treatment. ——The question is ever brought up anew as to the material used for roofing our early mediæval monuments. It is, however, incontestably proved by local evidence that a portion of Wetzlar Cathedral was roofed with perfectly-made tiles (16½ in. by 7½ in.) in the second half of the XIIth century, though fifty years later these were replaced by slate. Although in Wetzlar slate completely superseded tile, in the neighbouring Hessian provinces both materials were used simultaneously. ——Plans have been drawn out for enlarging the harbour of Harburg, which town lies 10 kms. south of Hamburg; 184 hectares have been added to the existing harbour, and upon this tract of land four basins will be constructed having a depth of 9·8 m. These will be in direct communication with the south Elbe, and will greatly facilitate traffic, for up till now large ships for Harburg have been obliged to berth at Altona or at Hamburg, while barges carried their cargoes to and from Harburg. The cost of carrying out the proposed additions will amount to 7,500,000 marks, plus the cost of the land, 3,800,000 marks.——In a paper read before the Institute of Architects and Engineers of Munich, Dr. Bredt pleads for a modern style which shall illustrate the requirements of our times. He backs his arguments by the statement that our forefathers erected their modern buildings side by side with the ancient work without destroying artistic effect, and we should also design modern buildings which need not be out of harmony with their ancient surroundings.

SWITZERLAND.—An electric cog-railway is to be laid from Bregenz to the summit of the Pfänder. The line will be 2·9 km. in length, and will climb a height of 575 m. The cost is estimated at 1,100,000 francs.——The Empress Eugénie has presented to the canton Thurgau the charming XVIIth century Castle of Arenaberg, situated on the Lake of Constance, where Napoleon III. lived as Prince Napoleon. The castle contains much good furniture and other works of art, collected during two centuries, and now rearranged by Herr Pietri, the Empress's representative.

ITALY.—The defacement of the Apponale Clock Tower, Riva, is to be feared. This tower, dating from the XIIth and XVIth centuries, is a characteristic feature of the town, and the present intention is to remove the attractive barocco tiled roof, and replace it with a "correct ornate Gothic" spire.

SOUTH AFRICA.—Notwithstanding the general depression which still obtains in Johannesburg, there is stated to be a fair amount of work in the building trade along the several routes of the new electric trams in the East Rand.——At Clifton, the foundation-stone of the new parish hall has been laid. The building is being erected at the junction of Loveday and Siemert streets by Mr. F. W. Parkin, the architect being Mr. J. Moodie.——Sir Hamilton Goold-Adams, the Lieut.-Governor, recently laid the foundation-stone of the new Grey College and University, near Bloemfontein, towards the erection of which the Government have voted 125,000*l*., the site being a gift of the Town Council.——The annual Report of the Incorporated Law Society, presented at the meting in Cape Town, stated that the idea of erecting suitable law courts in Cape Town had made some progress. "A design has been selected out of the many submitted, and the specification for the building has been, by the courtesy of the Attorney-General, shown to your council for their suggestions. In view of the very inadequate provision for the conduct of legal work at present, the urgency for the completion of these buildings is very great."

Miscellaneous.

PROFESSIONAL AND BUSINESS ANNOUNCEMENTS.—Messrs. R. J. Nicholson & Co., electrical and mechanical engineers, have removed from Bank-buildings, Cannon-street, Manchester, to Macdonald's-lane, Corporation-street, Manchester.——Messrs. Jay, Broll, & Co., 31, Old Queen-street, Westminster, have been appointed London managers to the Asbestos Paint Company, of Birmingham.——Messrs. T. T. Gething & Co., quarry owners (Warwick-road, Kensington), have purchased from the Trustees of the late T. P. Lilly the business (including lease, stock, and plant) of the well-known Chilmark quarries.

CURIOUS BRACKETS.—There is a very quaint bracket supporting one of the ribs of the north aisle vaulting at Kiedrich, two miles from Ettoille-am-Rhein, the beautiful pilgrimage resort between Rüdesheim and Mainz. It represents, when viewed in one position, the head of St. Thomas Aquinas; but in another position it shows an unmistakable calf's head, obviously intended to render symbolically the "Dumb Ox of the Sorbonne," which nick-name he earned at that college. The enormous ear he is given does duty also as snout for the calf's head. Close to is another bracket, representing a slender female figure, apparently, down to the waist, with the arms akimbo, and holding a book; but, curious as it is, the one of St. Thomas is the only one to which the attention of visitors is called. The church, which is galleried, has a beautiful rich vaulting, with many coats of arms, especially in the choir, and a fine XIVth century "Sacrament House," wonderful altars, and richly-carved pews, all Gothic. The whole fabric, indeed, is worthy of the closest study; but the quaint St. Thomas there will haunt one, even if nothing else there does. In the adjacent St. Michael's Chapel in the churchyard is a superb candelabrum, with a double statue of the Madonna, back to back, and the east end of the chapel is rectangular, with an apse let in, supported outside with rich mouldings on a shaft. A crypt is beneath.

A NEW FORM OF STEEL PILE.—The steel piles invented by Mr. William Clarke, of Ayr, consist of specially rolled sections which can be made in any length up to 70 ft., and from 1 ft. to 3 ft. wide. Two types of piles, of channel and I-section respectively, are contemplated by the patentee, one intended for permanent and the other for temporary work. In either case the adjoining piles are connected by a dovetailed joint, one side of each section containing a groove and the other a corresponding tongue which does not fill up the entire space and leaves room for suitable packing material. For permanent work the channel piles can be driven in the ordinary manner. In the construction of a dock, breakwater, pier, or similar structure, the procedure recommended is to drive the piles to the form and in the line of the structure and to within 2 ft. 6 in. of the top level so that the work may be finished with a granite coping of that thickness. After the piles have been driven, the open space within the dovetailed joint is to be filled up with rust cement to make the work watertight. By bracing and shoring the piles from behind, the water may be pumped out, thus leaving the area within perfectly dry for the workmen, and, after the foundations have been taken down to the depth required, the interior may be filled up to the desired level with concrete. The bracing and the piles remain permanently in their places forming a wall with a steel face. The I-section piles for temporary cofferdams are applied in a similar manner, and the piles can be witddrawn when the work is finished for use elsewhere. The procedure in this case is to surround the proposed work, at a distance of 3 ft. or 4 ft., with one row of piles and to fill up the space in the joints with oakum or other material. The enclosed area will then be watertight and excavation can be commenced at once. The idea represented by the piles here mentioned is realised in a far better way by previously patented forms of steel sheet-piling made of standard sections which are readily obtainable and can be used for structural work if required after having served their purpose as temporary piling. Apart from the objections that apply to all specially rolled sections, the form of joint adopted for the Clarke piles is one that cannot be completely finished in the rolling mill so as to insure uniform contact, and if, as suggested by the drawing we have received, the grooves and tongues have to be machined, the extra work thereby entailed must mean a considerable addition to the cost.

MANDEVILLE MEMORIAL, CORK.—The monument to John Mandeville and to the three men, Lonergan, Shinnick, and Casey, was unveiled by Mr. William O'Brien, M.P., on the 8th inst. The memorial consists of a figure of Mandeville in bronze on a pedestal of limestone, on the panels of which are engraved the names of Lonergan, Shinnick, and Casey. The sculptor is Mr. Doyle Jones.

SCOTTISH BUILDING TRADES FEDERATION.—The twelfth annual general meeting of the Scottish Building Trades Federation was held on the 7th inst. in the Building Trades Exchange, 26, George-street, Edinburgh. Mr. Patrick Knox, president, occupied the chair. Reports on the state of trade by the different branches indicated that the building trade was in a very depressed condition. Mr. Patrick Knox was re-elected president, and Mr. William Nicoll, Dundee, vice-president. It was agreed that the headquarters of the Federation should be permanently fixed in Edinburgh, and that Mr. James Cameron, solicitor, Edinburgh, should act as permanent secretary and treasurer. It was arranged that the half-yearly meeting of the executive should be held in Edinburgh in April next year, and that the annual general meeting should be held in Dundee next September. In the evening the members dined at the Royal Hotel, under the presidency of Mr. Patrick Knox. Mr. William Nicoll, Dundee, and Mr. James Leslie, Aberdeen, acted as croupiers. Mr. Thomas Hume, proposing "The Scottish Building Trades Federation," spoke of the value of the Federation to the trade. Not a day passed without their reading something about the unions of the workmen, which more than ever were before the public, largely because of their now having so many representatives in Parliament. He hoped the Federation would become so strong that they too would be able to send members to Parliament to look after their interests. The President, in the course of his reply, congratulated the delegates on the spirit which had pervaded the meeting held that day. Mr. William M'Donald, Inverness, proposed "The Edinburgh, Leith, and District Building Trades Association," and Mr. R. Lamb replied.

NORTHERN POLYTECHNIC INSTITUTE.—The work of the architectural and building section is now organised in four sections, viz.:—(1) The architectural and building day school; (2) the building day trade school; (3) manual training courses; (4) evening classes. The architectural and building day school for young architects, builders, and surveyors, is provided with a third-year course of day study to be taken by pupils if desired. A new special two years' evening continuation course for advanced students is also provided as an alternative to the third-year day course. The second-year course is in part differentiated so that pupils who intend to become builders or estate surveyors may have opportunities of taking special classes in correspondence and book-keeping, and in office routine and business methods. The day trade school is an entirely new departure, and has been established as the result of a conference of building employers and others held at the Polytechnic last winter. The object of this school is to partially replace the apprenticeship system. For the purposes of this school, new building extensions are contemplated, and will, it is hoped, be available about the end of the year. Another feature to be introduced this year is the improved system under which building construction will be taught. Hitherto the almost universal method of instruction in this subject has consisted of lectures on a comprehensive series of building details, followed by production of drawings of detached items of construction. In spite of the teachers' best efforts the drawings too often remained mere abstractions to the student, while his concrete ideas of building construction were diffuse, incomplete, and of meagre use in the corelation necessary for the simplest design. The system of comprehensive, but quite disjointed, analysis will be replaced by synthetic method. The study of details will be corelated, leading up to a single but complete and unified design of a building. Large scale take-to-pieces models of complete buildings have been provided for this purpose.

A PICTURE ASCRIBED TO RUBENS.—It is stated that a picture, which has just been discovered in a house at Austruweel, near Antwerp, is pronounced by experts to be an example of Rubens. The painting is on canvas, 5 ft. by 4 ft., and was formerly in the parish church, having been taken thither from Antwerp eighty years ago. It delineates the Assumption of the Virgin, with apostles and holy women opening her tomb as she ascends to heaven.

BERKELEY CHAPEL, MAYFAIR.—The site of this chapel, at the corner of Charles and John streets, has been taken for the erection of new buildings after plans and designs by Mr. R. G. Hammond. The chapel, built after the "Georgian" style, contained sittings for 1,100 persons; a memorial window to the late Duke of Clarence was set up there in May, 1894.

PROTECTION OF WOODEN PILES IN WATER.—The *United States Railway Gazette* contains a description of an appliance which, the inventors assert, will effectively shield wooden piles from attacks by the teredo worm. The pile is enveloped at the surface of the water in a pipe made of cement, and divided lengthwise into two halves keyed together with a scarf joint. The pipe sections are lowered around the pile to the water bed, and then, having settled to the extent of a few inches, are filled with a core of sand around the pile they enclose.

SCHOOL OF ART WOOD-CARVING.—The School of Art Wood-carving, South Kensington, which now occupies rooms on the top floor of the new building of the Royal School of Art Needlework in Exhibition-road, has been reopened after the usual summer vacation, and we are requested to state that some of the free studentships maintained by means of funds granted to the school by the London County Council are vacant. The day classes of the school are held from 10 to 1 and 2 to 5 on five days of the week, and from 10 to 1 on Saturdays. The evening class meets on three evenings a week, and on Saturday afternoons. Forms of application for free studentships and any further particulars relating to the school may be obtained from the manager.

SCHOOL ARCHITECTS AND PLANS.—At the meeting of the West Ham Education Committee on Monday, the Works Sub-Committee reported having been informed by the architect (Mr. Jacques) that some difficulty had arisen with the auditor on the interpretation of the agreement entered into by the late School Board and himself on his appointment with reference to payment for lithography of specifications, in consequence of the following clause:—"For which commission the architect undertakes to prepare and supply all necessary plans, drawings, and specifications, and copies thereof." The architect had always provided at his own expense the necessary plans and specifications for carrying out the work, but the expense of providing an additional number of copies of the specifications for the use of contractors desirous of tendering for works had always been borne by the late School Board. In some instances, the cost of lithographed specifications required for school cleansing purposes exceeded the entire fees received by the architect as commission for the work. The Committee recommended, in order to make the matter perfectly clear, that the agreement entered into with Mr. Jacques be endorsed so as to definitely show that he is responsible only for preparing the necessary plans and specifications required for the execution of works, and not for lithographed copies supplied to contractors to enable them to tender, which, when the architect considers them necessary, shall, as heretofore, be paid for by the Education Committee. The report was adopted.

Legal.

EXETER BUILDING DISPUTE.

THE case of Smith *v.* Stuckey's Banking Company, Ltd., and others, came before Mr. Justice Sutton, sitting as Vacation judge, on the 12th inst., on an application by plaintiff for an interim injunction to restrain the defendant Company and Messrs Luscombe & Sons, Ltd., a firm of builders, until the trial from further pulling off the roof of No. 253, High-street, Exeter. The plaintiff also asked that the defendants should be ordered to restore the premises into the state into which they formerly were.

Counsel, in support of the application, said the plaintiff was in possession of the premises, No. 253, High-street, Exeter, as a monthly tenant under an agreement dated July 20, 1903, he carrying on there the business of a hairdresser. The landlord sold the premises to the defendant Banking Company early in the present year, and it was in the interest of the Bank to get rid of the plaintiff as the tenant as soon as possible.

Mr. Bramwell Davis, K.C., said he appeared for the defendants, and his point was that the Bank gave the plantiff notice on April 21 to determine his tenancy on May 21, and that, as the plaintiff had not gone out of possession, he must be treated as a trespasser. His case, therefore, was that his lordship would not grant the injunction asked for.

Counsel for the plaintiff said he admitted the notice in question to terminate the tenancy was given, but his case was that that that notice had been waived, and that an entirely new agreement was entered into which set aside the old agreement.

After considerable discussion, his lordship intimated that, in his opinion, the plaintiff's remedy, if any, was damages. He refused to grant the injunction, on the Bank undertaking not to take any steps to turn the plaintiff out of possession for seven days.

NEWINGTON SEWAGE DISPUTE.

THE case of the London General Omnibus Company, Ltd., *v.* the Tilbury Contracting and Dredging Company (1906), Ltd., came before Mr. Justice Sutton, in the Vacation Court, on the 12th inst., on a motion by the plaintiff Company for an interim injunction to restrain the defendants until the trial or further order from making a certain sewer, injuring the plaintiffs' premises at Newington.

Mr. Bramwell Davis, K.C., in support of the motion, said that the defendants had filed certain affidavits, and from these it appeared that the sewer was practically completed. All the excavations in connexion with the sewer were over, and the sewer would be completed in a few days. The only direction he asked for was that no order should be made on the present motion, and that the costs should be made costs in the action. Defendants said that in what they did they were acting under the direction of the London County Council. The plaintiffs had not made the London County Council defendants to the action, and he, therefore, asked for leave to amend the writ by adding the Council as defendants in case it was found that it was essential that that course should be pursued.

Mr. Mulligan, K.C., on behalf of the defendants, assented to the application of Mr. Bramwell Davis. He said that the defendant Company was an important one, and throughout the work in question defendants had acted under the supervision of the London County Council, and it was on the evidence that the defendants had carried out the work with the utmost care, and that every possible precaution was taken to prevent damage.

Mr. Bramwell Davis: You must not say that, because that will have to be determined at the trial of the action.

Mr. Mulligan said that the defendants had finished all the excavations in the front of the plaintiffs' land, and plaintiffs had therefore no further cause of complaint. He acceded to the application of his learned friend that there should be no order on the motion except that the costs should be made costs in the action.

Patents of the Week.

APPLICATIONS PUBLISHED.*

18,000 of 1905. R. MARSHALL: *Attachment for Fire Grates.*

This relates to an attachment for fire grates, and consists of a single piece of sheet metal provided with ledges adapted to carry smoothing irons during heating, and convertable into a trivet or cooking tray, acting as a fuel economiser and guard when arranged to close in front of the grate.

23,781 of 1905.—G. T. MOORE: *Elevator for Window Sashes and the like.*

This relates to a window elevator, consisting of the combination of a rotatably-mounted toothed quadrant, a handle for rotating said quadrant, means associated with said handle for enabling it and the quadrant to be held in varying positions, a pinion engaging with said quadrant and adapted to be rotated thereby, a spindle upon which said pinion is keyed, a pulley keyed upon said spindle, and a flexible connexion between the window sash and the said pulley operating to elevate the window sash when the pulley revolves in one direction.

24,636 of 1905.—G. O. H. KLOPP: *Cocks or Taps.*

This consists in the combination with a cock or tap of a coiled spring, whereby the ball-valve will be firmly held against the seating in the outlet chamber, except when positively forced therefrom, notwithstanding diminution of the pressure of the water supply or the total cutting off of the supply.

24,787 of 1905.—H. RUDDER and J. C. ROUSE: *Hinges for Doors and Gates.*

This relates to hinges for doors and gates, and consists in the provision of an extension of the strap or the like, having U-shaped notches, with a depending pin and nut acting in conjunction with a post-plate with horizontal seating having radial slots therein and projections, the pin of the extension working in the radial slots, and the notches of the extension engaging the projections on the seating of the post-plate.

26,462 of 1905.—J. FABRITIUS: *Building and like Structures.*

This relates to a composite structure for building purposes, comprising one or more courses of bricks provided with outside irons, connecting parts of any desired cross-section, and a wrapping or winding of wire for binding the whole together, the whole construction being finally covered with cement.

* All these applications are in the stage in which opposition to the grant of Patents upon them can be made.

PATENTS.—*Continued on page 359.*

List of Competitions, Contracts, etc.

For some Contracts still open, but not included in this List, see previous issues. Those with an asterisk (*) are advertised in this Number: Competitions, —; Contracts, iv. vi. viii. x.; Public Appointments, —; Auction Sales, xxviii.

Certain conditions, beyond those given in the following information, are imposed in some cases, such as: the advertisers do not bind themselves to accept the lowest or any tender; that a fair wages clause shall be observed; that no allowance will be made for tenders; and that deposits are returned on receipt of a bonâ-fide tender unless stated to the contrary.

Contracts.

BUILDING.

SEPTEMBER 24.—**Altwen.**—TWO SHOPS.—Altwen and Pontardawe Co-operative Society, Ltd., invite tenders for the erection of two shops at Altwen. Plans, etc., and all particulars can be obtained at the offices of the architect, Mr. Charles S. Thomas, Herbert-street, Pontardawe, or Wind-street, Swansea. Tenders to be sent in to the Secretary, Mr. Walters, Altwen, near Pontardawe, on or before September 24.

SEPTEMBER 24.—**Archiestown.**—CHURCH REPAIRS, ETC.—Tenders are invited for the mason, carpenter, slater, plumber, plasterer, and painter works for repairs and improvements at the United Free Church and Manse, Archiestown. The plans and specifications may be seen at the Manse and with Mr. John Wittet, architect, Elgin, with whom tenders must be lodged by September 24.

SEPTEMBER 24.—**Middlesbrough.**—CHURCH.—For the whole or the various works required in the erection of Wesleyan Church, Woodlands-road, Middlesbrough. Names to Messrs. Danby & Simpson, architects, 73, Albion-street, Leeds, not later than September 24, when quantities and other information will be forwarded.

SEPTEMBER 24.—**Pengam.**—HOTEL.—Tenders are required for the erection of new hotel, adjoining the station approach at Pengam (Rhymney Railway) Station, Glam., for Messrs. Griffiths Brothers, Ltd. Bills of quantities can be obtained upon deposit of 1*l.* 1s. Drawings inspected at offices of Messrs. Lansdowne & Griggs, architects, Metropolitan Bank Chambers, Newport, Mon. Tenders must be sent not later than 4 p.m., September 24.

SEPTEMBER 25.—**Abergavenny.**—ADDITIONS TO TOWN HALL, ETC.—Tenders are invited for alterations and additions to the Town Hall, Abergavenny. Plans and specifications may be seen, and bills of quantities obtained (on payment of a deposit of 2*l.* 2s.), at the offices of the architect, Mr. E. A. Johnson, F.R.I.B.A., Abergavenny. Endorsed tenders to be sent to Mr. J. T. Rutherford, Town Clerk, not later than September 25.

SEPTEMBER 25.—**Conna.**—RESIDENCE.—Tenders are invited for the building of a teacher's residence at Conna, according to the plans and specifications to be seen daily at the residence of the Rev. J. Murphy, P.P., Conna. Tenders to be delivered by September 25.

SEPTEMBER 25.—**Kingston-on-Thames.**—CLUB ENLARGEMENT.—The Committee of the Gladstone Liberal Club invite tenders for proposed addition to their premises. Plan and specifications can be obtained of the Secretary, Mr. B. A. Keene, Elm-road, Kingston-on-Thames. Tenders to be delivered not later than noon, September 25.

SEPTEMBER 25.—**Newtonmore, N.B.**—ADDITIONS.—Estimates required for the mason, carpenter, slater, plumber, plasterer, painter, and glazier works of additions to property at Newtonmore. Plans and specifications to be seen with Mr. Alex. Cattanach, architect, The Laurels, Kingussie, who will receive offers up till September 25.

SEPTEMBER 26.—**Belfast.**—ADDITION TO ABATTOIR.—The Market Committee invite tenders for erection of a building at the Abattoir, M'Auley-street. Drawings and specification may be seen in the City Surveyor's Office, and a bill of quantities obtained, on payment of 1*l.* 1s. Sealed tenders on office forms, endorsed "Tender for Abattoir," to be lodged with Sir Samuel Black, Town Clerk, Town Hall, Belfast, before 10.30 o'clock a.m. on September 26.

SEPTEMBER 26.—**Linthwaite.**—WAREHOUSE, ETC.—Tenders are invited for the various works required in the erection of warehouse, dyehouse, offices, and stables, Manchester-road, Linthwaite. Plans may be seen, and quantities obtained, at offices of Messrs. Lunn & Kaye, architects and surveyors, Milnsbridge, to whom sealed and endorsed tenders must be sent no later than 5.30 p.m., September 26.

* SEPTEMBER 27.—**Ashford.**—LAUNDRY.—The Managers of the West London School District invite tenders for the building of a laundry at their schools at Ashford, Middlesex. Copies of the specification, bills of quantities, and tender forms may be obtained, and the drawings and site inspected, on application to Mr. F. G. Beeching, Clerk to the Managers, Ashford, Middlesex, between 10 and 4, with deposit of 5*l.* The site must be inspected. Tenders to the above (as per instructions with the forms) before 6 p.m., September 27.

SEPTEMBER 27.—**Withernsea.**—SCHOOL, ETC.—The Education Committee of the East Riding of the County of York invite tenders for the erection of an infants' school and for additions and alterations to the Council School, Withernsea. Plans and specifications may be seen, and form of tender and copies of quantities obtained, on application to the Building Surveyor, County Hall, Beverley, upon depositing 1*l.* 1s. The plan and specification can also be seen at the Council School, Withernsea. Tenders, endorsed "Withernsea Council School," to be forwarded to Mr. John Bickersteth, Clerk to the East Riding Education Authority, County Hall, Beverley, not later than September 27.

SEPTEMBER 28.—**Havant.**—HOUSE.—Tenders are invited for the erection of a house at Denvilles, Havant. Plans and specifications may be seen at the offices of the surveyors, Messrs. Hall, Pain, & Goldsmith, 48, West-street, Fareham, and quantities and forms of tender obtained. Tenders should be delivered to the surveyors not later than September 28.

* SEPTEMBER 28.—**Hemel Hempstead.**—NEW BRIDGE, ETC.—The Hertfordshire C.C. invite tenders for the rebuilding of a county bridge and works of widening the main road embracing alterations to buildings at Two Waters, Hemel Hempstead. Specifications, agreement, etc., may be seen at the County Surveyor's Offices, Hatfield, between 10 and 4. A copy of the specification and schedule of works and prices and a form of tender can be obtained at the County Surveyor's Office on payment of 2*l.* 2s. Sealed tenders, endorsed "Tenders for New Bridge and Works at Two Waters," must be delivered to Mr. Urban A. Smith, County Surveyor, Hatfield, not later than September 28.

SEPTEMBER 28.—**Saintfield.**—ADDITIONS TO MANSE.—Tenders are invited for making alterations and additions to Second Presbyterian Manse, Saintfield, County Down. Plans and specifications to be seen at the Manse, Saintfield, or at Messrs. Hobart & Heron, architects, 124, Scottish Provident Buildings, Belfast, by whom tenders will be received up to September 28.

SEPTEMBER 28.—**South Elmsall.**—WAREHOUSE, ETC.—For alterations to present shop, erection of warehouse, and stables, at South Elmsall Branch Stores, for the Pontefract Industrial Society, Ltd. Names to the architects, Messrs. Garside & Pennington, Ropergate, Pontefract, and at Castleford. Sealed and endorsed tenders to be forwarded to Mr. W. A. Chappell, Secretary, The Stores, Pontefract, on or before September 28.

SEPTEMBER 28.—**West Bromwich.**—ERECTION OF SMITHY.—Tenders are required for the erection of smithy, etc., at the Walsall and West Bromwich District Schools, West Bromwich. Plans and specifications and conditions of contract may be seen at the offices of Mr. J. W. Allen, architect, High-street, West Bromwich, from whom forms of tender may be obtained. Tenders, under seal and marked "Tenders for Smithy," must be sent to Mr. H. Ward, Clerk, West Bromwich, on or before September 28.

SEPTEMBER 29.—**Ballygawley.**—PAROCHIAL HOUSE IMPROVEMENTS.—Tenders are invited for the building of a wing, and for the execution of improvements, to the Parochial House, Ballygawley, County Tyrone, for the Rev. Peter M'Shane, P.P. Plans and specification may be seen at the Parochial House, Ballygawley; or at the offices of Mr. J. V. Brennan, architect, Belfast Bank Chambers, to whom sealed tenders are to be delivered not later than September 29.

SEPTEMBER 29.—**Coundon.**—ADDITIONS TO INN.—Tenders required for additions to "Hare and Hounds" Inn, Coundon. Plans and specifications may be seen at the office of Mr. T. H. Murray, architect, Consett. Tenders to be sent in on or before September 29.

SEPTEMBER 29.—**Loughrea.**—CHURCH ADDITIONS.—Tenders are invited for works of addition and improvement to Duniry and Abbey churches, Loughrea, for the Rev. Patrick Egan, P.P. Plans and specifications can be seen at Parochial House, Duniry, or at the offices of Mr. William A. Scott, M.S.A., architect, 45, Mountjoy-square, Dublin. Tenders must be delivered on or before September 29.

SEPTEMBER 29.—**Pelynt.**—REPAIRS.—Tenders are invited for the execution of repairs to the buildings, hedges, and gates of the Benefice of Pelynt, Cornwall. Specifications of the works can be seen at the Vicarage, between the hours of 10 and 4. Tenders to be sent not later than September 29, 1906, to Mr. J. M. Strong, Diocesan Surveyor, St. Stephen's, Launceston.

SEPTEMBER 29.—**Penzance.**—SEAMEN'S INSTITUTE.—Tenders are invited for the erection of a Seamen's Institute at Green-street, The Quay, Penzance. Drawings and specifications may be seen at the offices of the architect, Mr. Oliver Caldwell, F.R.I.B.A., Penzance, to whom tenders are to be sent on or before September 29.

OCTOBER 1.—**Warleggan.**—CLOAK-ROOM, ETC.—Cornwall Education Committee invite tenders for proposed new cloak-room, etc., at the Warleggan School, according to plans and specifications, which may be seen at the school or at the office of Mr. B. C. Andrew, Architect to the Committee, Biddick's-court, St. Austell. Forms upon which tenders must be made may be obtained at the school or from the Architect. Sealed endorsed tenders must be sent to Mr. F. R. Pascoe, Secretary, Education Office, Truro, on or before October 1.

OCTOBER 3.—**Nether Alderley.**—SCHOOL ALTERATIONS.—Macclesfield and Hayfield Education Sub-Committee invite tenders for alterations at Nether Alderley Council School. Specification and quantities may be obtained from Mr. H. Beswick, County Architect, Chester. Tenders, addressed to the Chairman, must be sent to Mr. J. Fred. May, Clerk to the Committee, Church Side, Macclesfield, by October 3.

OCTOBER 3.—**Weymouth.**—FERRO-CONCRETE RETAINING WALL.—The Weymouth T.C. invite tenders for constructing and maintaining retaining wall, about 500 ft. in length, of ferro-concrete work (Hennebique's system) on the north side of the Pile Pier within the borough, filling in and levelling up between the existing pier and the intended wall, new fences, Portland stone coping, and other works appertaining thereto. Plans, specification, and condition of contract may be seen, and form of tender obtained, on application at the office of the Borough Engineer, Mr. W. Barlow Morgan, Municipal Offices, Weymouth. Tenders, enclosed in the official envelope, sealed, and endorsed "Retaining Wall Pile Pier," to be delivered to Mr. H. A. Huxtable, Town Clerk, Municipal Offices, Weymouth, on October 3 by 10.30 a.m.

OCTOBER 4.—**Broughton.**—TOWN HALL IMPROVEMENTS.—The Town Halls and Markets Committee invite tenders for additions and alterations to the Town Hall Building, Duke-street, Broughton. Forms of tender and copies of bills of quantities may be obtained, and plans, etc., seen, at the Borough Engineer's Office, Town Hall, Salford. Tenders, endorsed "Broughton Town Hall Extension," and addressed to the Chairman of the Town Halls and Markets Committee, Town Hall, Salford, must be delivered at the office of Mr. L. C. Evans, Town Clerk, Town Hall, Salford, not later than 9.30 a.m. on October 4.

OCTOBER 6.—**Wickham Market.**—WORKHOUSE ADDITIONS.—The Guardians of Plomesgate Union invite tenders for the erection of additions to the infirmary and laundry at the Union Workhouse, Wickham Market, in accordance with the plans and specification, which, with the contract and bond, can be inspected at the Workhouse. Tenders, endorsed "Workhouse Additions," are to be addressed to Mr. T. Waller Read, Clerk, Board-room, Wickham Market, not later than October 6.

OCTOBER 8.—**Carrick-on-Shannon.**—POST OFFICE.—Board of Public Works invite tenders for the erection of a new Crown Post Office at Carrick-on-Shannon, co. Leitrim. The plans and specification can be seen at the Post Office, Carrick-on-Shannon. Forms of tender and bills of quantities will be supplied on deposit of 1*l.* The separate envelopes containing the tender and the bill of quantities must be endorsed, and sent to Mr. H. Williams, Secretary, Office of Public Works, Dublin, not later than 10 a.m. on October 8.

* OCTOBER 11.—**Lambeth.**—ALTERATIONS TO BATHS.—The Lambeth Borough Council invite tenders for alterations and extensions of Baths and Wash-houses in Kennington-road. Plans can be seen, and specification and bills of quantities obtained, at the office of the Borough Engineer, between 10 a.m. and 12 noon and 2 p.m. and 4 p.m. (Saturdays excepted). Sealed tenders, endorsed "Tenders for Building Work, Kennington Baths," to be delivered to the Town Clerk, Town Hall, Kennington Green, not later than 12 noon, October 11.

* OCTOBER 12.—**Newport.**—INFIRMARY.—The Newport (Salop) Guardians invite tenders for the erection of infirmary buildings. Plans and specifications can be seen, and bills of quantities and forms of tender obtained, on application to Messrs. Fleeming & Son, architects, Bank-chambers, Wellington, Salop. Tenders to be delivered to the Clerk to the Guardians, Newport, not later than 9 o'clock a.m., October 12.

* OCTOBER 13.—**Paddington.**—BUILDING BRIDGE.—The Borough Council of Paddington invite tenders for pulling down bridge, and constructing and erecting new brick, concrete, and steel carriageway bridge (30-ft. span), new toll-keeper's office, etc., in and about Warwick-avenue. Forms of tender, specifications, Bills of quantities, etc., obtainable on application to Borough Surveyor. Drawings may be seen, and further particulars obtained, from 10 a.m. to 4 p.m. (Saturdays, 10 a.m. to 1 p.m.), as above. Sealed tenders, endorsed "Reconstruction of Warwick-avenue Bridge." "No. 1 Building Constructional Works," "No. 2 Steel Works," or "No. 3, Nos. 1 and 2 together," to be delivered to the Town Clerk, Town Hall, Paddington, W., not later than October 13.

* OCTOBER 15.—**Coventry.**—BUILDINGS.—The Gas Committee of the Coventry Corporation invite tenders for buildings at their Foleshill Works. The drawings may be seen, and specifications, with form of tender and bill of quantities obtained, on and after October 1, on payment of 1*l.* 1s. Sealed tenders, addressed to the Chairman of the Gas Committee, Gas Works, Coventry, endorsed "Tender for Retort House and Coal Stores, etc.," must be delivered before 9 a.m., October 15.

* OCTOBER 20.—**Stafford.**—SCHOOL.—The Staffordshire Education Committee invite tenders for new high school for girls, Stafford. Builders desiring to tender should apply to Mr. Graham Balfour, Director of Education, County Education Offices, Stafford, on or before October 20. Quantities will be supplied on payment of 2*l.* 2s.

NO DATE.—**Kirkhill.**—HOUSE.—The erection of a house (separate trades) at Kirkhill, Dunbar. Names to Messrs. Davidson & Phillipson, architects, Pearl Buildings, Newcastle-on-Tyne, who will supply particulars and bills of quantities.

NO DATE.—**Royston.**—DWELLING-HOUSE, ETC.—Tenders are invited for building dwelling-house, office, shop, etc., for Royston Gas Company. Apply at the Office, Royston, near Barnsley.

NO DATE.—**Sandsend.**—VILLAS.—Tenders for the erection of a pair of semi-detached villas at "Meadowfields," Eastrow, Sandsend, for Capt. Charles McGregor. Application for quantities to be made to Mr. Thomas Dowson, architect and surveyor Central Chambers, Baxtergate, Whitby.

NO DATE.—**Tunstall.**—BUILDING WORK.—Tenders are invited for new building at the Henry Richards Tile Works, Tunstall. Particulars can be obtained from Messrs. A. R. Wood & Son, architects, Tunstall.

ENGINEERING, IRON, AND STEEL.

SEPTEMBER 24.—**Dublin.**—BOILERS.—The Improvements Committee of the Corporation of Dublin invite tenders for the supply and erection of two boilers, locomotive type, with necessary steam and water supply pipes, at the East-road Pumping Station. The drawings, specification, and form of tender may be inspected at the office of the City Engineer, City Hall, Dublin, between the hours of 11 and 4 p.m. daily (Saturdays excepted), and copies may be obtained on payment of 1*l.* 1s. Tenders, sealed and addressed to the Chairman of the Improvements Committee, City Hall, Dublin, and endorsed "Tender for Boilers, East-road," must be received by Mr. Patrick Tobin, Secretary Improvements Committee, City Hall, Dublin, not later than 12 o'clock noon on September 24.

SEPTEMBER 24.—**Newton Abbot.**—CONCRETE BRIDGE.—The U.D.C. of Newton Abbot invite tenders for the construction of a concrete bridge over the stream by Cricket Field-terrace, and other works in connexion therewith. Plans and particulars can be seen at the office of the Surveyor, Lewis Stevens, the Town Hall, Courtenay-street, Newton Abbot, from whom bill of quantities can be had on payment of 1*l.* 1s. Sealed tenders, endorsed "Cricket Field Bridge," to be sent to Mr. Francis Watts, Clerk, 31, Courtenay-street, Newton Abbot, not later than 3 o'clock p.m., September 24.

SEPTEMBER 25.—**Manchester.**—STEEL PARAPET.—The Improvement and Buildings Committee invite tenders for the erection of a steel parapet, etc., at Oxford-street Bridge, over the Rochdale Canal. Drawing may be seen, and specification and form of tender obtained, on application at the City Surveyor's Office, Town Hall, Manchester, on payment to the City Treasurer of 1*l.* 1s. All cheques or postal orders are to be made payable to the order of "The Corporation of Manchester." Tenders, enclosed in the official envelope, and addressed to the Chairman of the Improvement, etc., Committee, to be delivered at the City Surveyor's Office not later than 10 a.m. on September 25.

SEPTEMBER 25.—**Stockton-on-Tees.**—URINAL.—The Corporation is prepared to receive tenders for the erection of a urinal in Bowesfield-lane. Plans and specification may be seen, and further information obtained, at the Borough Engineer's Office, Town Hall, Stockton-on-Tees. Tenders, endorsed "Urinal," to be sent to Mr. Arthur B. Crosby, Town Clerk, Borough Hall, Stockton-on-Tees, not later than 10 a.m. on September 28.

* SEPTEMBER 25. — **Willesden.** — WROUGHT-IRON FENCING.—The Willesden District Council invite tenders for 2830 ft. lineal of wrought-iron unclimbable adjustable fencing, 4 ft. 6 in. in height, and two pairs of 9-ft. gates of similar pattern to fencing, delivered to New Recreation Ground, Harrow-road, Stonebridge, Willesden, N.W. Specification and form of tender can be obtained on application to Mr. O. Claude Robson, Council's Engineer, Public Offices, Dyne-road, Kilburn, N.W. Tenders, on printed forms (with deposit of 10*l.*), and endorsed "Wrought-iron Fencing, Recreation Ground, Stonebridge," to be delivered at the Offices of the Council, not later than 4 p.m., September 25.

SEPTEMBER 26.—**Cardiff.**—BRIDGE.—Tenders are invited for widening the Masonry Bridge carrying Park-place over the docks feeder. Drawings and specification may be seen, and bills of quantities and forms of tender obtained, on application at the office of Mr. W. Harpur, M.Inst.C.E., City Engineer. Sealed tenders, endorsed "Park-place Bridge Widening," to be delivered at the office of Mr. J. L. Wheatley, Town Clerk, Town Hall Cardiff, not later than September 26.

SEPTEMBER 26.—**Padiham Junction.**—BRIDGE WIDENING.—The Directors of Lancashire and Yorkshire Railway invite tenders for the widening of the bridge over the Leeds and Liverpool Canal at Padiham Junction, Rose-grove, near Burnley. Plans and specification can be seen, and form of tender and quantities obtained, on application at the engineer's office, Hunt's Bank, Manchester. Tenders, endorsed "Tender for Widening Bridge at Rose-grove," to be sent to Mr. R. C. Irwin, Secretary, Hunt's Bank, Manchester, not later than 10 a.m., September 26.

SEPTEMBER 28.—**Dudley.**—LANCASHIRE BOILER.—The Guardians invite tenders for a new Lancashire boiler to be supplied and fitted at the Workhouse in accordance with specification, to be obtained upon deposit of 1*l.* 1s., from Mr. Gaius W. Coster, Clerk to the Guardians, Union Offices, Dudley, to whom tenders must be sent by 10 o'clock a.m. on September 28.

SEPTEMBER 29.—**Blackpool.**—TURBO PLANT.—The Electricity and Tramways Committee invite tenders for the supply and fixing of one 800 kw. to 1,000 kw. turbine direct-coupled to one 800 kw. single-phase alternator and one 500 kw. direct-current tramway generator; also for surface-condensing plant. Specification and conditions, with form of tender, may be inspected at the office of Mr. Charles Furness, Borough Electrical and Tramway Engineer, Blackpool, Electricity Works, West Caroline-street, and may be obtained on payment of 3*l.* 3s. Sealed tenders, endorsed "Tender for Turbo-Generators," must be addressed to the Chairman, Electricity and Tramways Committee, West Caroline-street, Blackpool, and be delivered not later than September 29.

SEPTEMBER 29.—**Southport.**—MOTORS, PUMPS, ETC.—The Corporation of Southport invite tenders for the whole or any portion of the following:—Contract No. 1, electric motors and pumps; contract No. 2, gas engines and pumps; contract No. 3, revolving sprinklers for filter beds; contract No. 4, screening arrangements; required for their new Sewage Works at Crossens. The plans may be inspected and particulars obtained on deposit of cheque for 2*l.* at the office of Mr. R. P. Hirst, Assoc.M.Inst.C.E., Borough Engineer, Town Hall, Southport. Tenders, sealed, and endorsed "Contracts Nos. 1, 2, 3, or 4," to be delivered at the office of Mr. J. Ernest Jarratt, Town Clerk, Town Hall, Southport, on or before 12 noon, September 29.

OCTOBER 4.—**Weymouth.**—SURFACE-WATER DRAINAGE.—The Weymouth U.D.C. invite tenders for the construction of surface-water sewers within their district, with the necessary outlet, flap chamber, overflow weir, manholes, gullies, and other works in connexion therewith. Plans, sections, specification, and conditions of contract may be seen, and quantities and form of tender obtained, on payment of 2*l.* 2s., on application at the office of the Borough Engineer, Mr. W. Barlow Morgan, Municipal Offices, Weymouth. Tenders, enclosed in the official envelope, sealed, and endorsed "Surface-water Drainage," to be delivered to Mr. H. A. Huxtable, Town Clerk, Municipal Offices, Weymouth, on October 4 by 12 o'clock noon.

OCTOBER 6.—**Warrington.**—ENGINE REPAIRS.—The Water Committee invite tenders for repairs to their "Water Lily" pumping engine at Winwick Pumping Station. Particulars may be had from Mr. James Deas, A.M.I.C.E., Water Engineer, Municipal Offices. Tenders to be sent in not later than October 6.

OCTOBER 13. — **Wimbledon.** — WOOD-CUTTING MACHINERY.—The Corporation of Wimbledon invite tenders for the supply, delivery, and fixing complete at the Depôt, Queen's-road, Wimbledon, of a circular saw bench, band sawing machine, and a 12-h.p. electrical motor for driving same. Particulars may be obtained on application to the Borough Engineer and Surveyor, Town Hall, Wimbledon. Sealed tenders, endorsed "Wood-Cutting Machinery," to be delivered at the Town Hall on or before noon on October 13.

OCTOBER 20.—**Haverfordwest.**—RECONSTRUCTION OF MEAT MARKET.—The Corporation invite tenders for the reconstruction of the Meat Market, including new steel roof with elliptical lattice-braced principals, etc. The drawings and specifications may be inspected at the Council Chamber, High-street, Haverfordwest, between 10 a.m. and 5 p.m., or at the office of Mr. J. Preece James, architect, Tenby. A deposit of 2*l.* 2s. will be required. Tenders, sealed and endorsed "Reconstruction of Market," on the forms supplied, are to be sent to Mr. R. T. P. Williams, Town Clerk, Haverfordwest, on or before October 20.

NO DATE.—**Coston and Runhall.**—FOOT BRIDGE.—The Forehoe R.D.C. invite tenders for a new foot bridge over the river, between the Parishes of Coston and Runhall. Particulars may be obtained from Mr. Herbert Wade, District Surveyor, Crownthorpe, Wymondham.

NO DATE.—**Filey.**—RETORTS, ETC.—The Filey U.C. invite tenders for the extension of the retort bench and the setting of ten retorts. Particulars may be obtained of Mr. Henry Tobey, Engineer, Malton.

NO DATE.—**Stechford.**—BRICK CULVERT.—Construction of a 3 ft. by 2 ft. egg-shaped brick culvert, 400 ft. long, with manholes at the extremities, under the main London and North-Western Railway line at Stechford. Names to Mr. Charles F. Redfern, Surveyor, Whitehall Chambers, 23, Colmore-row, Birmingham.

MISCELLANEOUS.

SEPTEMBER 24.—**Alnwick.**—PILING.—R.D.C. of Alnwick invite tenders for piling about forty yards of the inner bank opposite the Major's-terrace at Warkworth. The specification may be seen upon application to Mr. Robt. Moore, Warkworth; or at the office of the clerk, Mr. H. W. Walton, Alnwick, to whom sealed and endorsed tenders are to be delivered before 1.30 p.m. on September 24.

SEPTEMBER 27.—**Carlisle.**—CARTING, ETC.—The Corporation of Carlisle invite tenders for the supply of horses, carts, and men required in the City Surveyor's Department. The contract will be let for a period of one, two, or three years, at the option of the Corporation. Specifications and conditions may be seen, and form of tender obtained, at the office of Mr. Henry C. Marks, M.Inst.C.E., City Engineer and Surveyor, 36, Fisher-street, Carlisle, to whom tenders, sealed and endorsed "Tender for Cartage," must be delivered on or before 10 a.m. on September 27.

SEPTEMBER 27.—**St. Austell.**—STEAM ROLLER.—St. Austell R.D.C. invite tenders for the hire, during the months of November, December, and January, or longer if required, of one steam roller, 10 tons in weight, with Morrison's patent scarifier attached. Tenders, marked "Steam Rolling Tender," to be sent to Mr. John Stephens, Clerk, office, Cross-lane, St. Austell, on or before September 27.

SEPTEMBER 28. — **Ashford.** — FENCING. — Ashford U.D.C. invite tenders for the supply and fixing complete of approximately 1,284 ft. run of all oak park fencing, 6 ft. high out of ground, at its Warren-lane hospital site. Plan and specification may be seen, form of tender, and information obtained, on application to Mr. William Terrill, Surveyor, at his office, North-street, Ashford, Kent. Sealed tenders, endorsed "Hospital Fencing," to be sent to Mr. John Creery, Clerk to the Council, 11, Bank-street, not later than 5 p.m. on September 28.

SEPTEMBER 29.—**Stourton.**—FENCING.—The Rothwell U.D.C. invites tenders for providing and erecting 490 yds. of creosoted red-wood fencing, 6 ft. high, round the New Sewage Disposal Works at Stourton. Also separate tenders for about 9 yds. of iron fencing, 5 ft. high, including fixing at the works. Plans and specifications can be seen, and particulars obtained, at the offices of the engineer, Mr. E. J. Silcock, M.Inst.C.E., 10, Park-row, Leeds. Sealed tenders, endorsed "Stourton Fencing" or "Iron Fencing," must be delivered to Mr. W. Dodgson, Clerk to the Council, Council Offices, Rothwell, near Leeds, not later than September 29.

OCTOBER 13.—**Ipswich.**—SCHOOL FURNITURE.—The Education Committee invite tenders for the supply of (*a*) cupboards and (*b*) desks and other furniture for the Clifford-road and Ranelagh-road Council schools. The tenders must be separate for (*a*) and (*b*), and for each school, and cupboards only may be tendered for, and tenders may be for one school only, if desired. Specifications and information may be obtained from the Committee's Surveyor (Mr. E. T. Johns, Tower Chambers, Tower-street, Ipswich) on deposit with him of 10s. Tenders, endorsed, to be sent to Mr. J. Hepburn Hume, Secretary, Tower House, Tower-street, Ipswich, on October 13.

NO DATE.—**Hertford.**—STEAM ROLLING.—The Hertfordshire C.C. invite tenders for the supply of steam road-rollers for use on the main roads in the county. Particulars and form of tender can be obtained on application to Mr. Urban A. Smith, M.Inst.C.E., County Surveyor.

NO DATE.—**Wetley Rocks.**—SHAFT SINKING AND WALLING.—Tenders are invited by the Westwood Coal and Iron Company for sinking and walling of two shafts on the Westwood Estate, near Wetley Rocks, Staffs. For particulars, apply to the Manager, (Mr. B. Parker), or to Westwood Manor, Wetley Rocks.

PAINTING, etc.

SEPTEMBER 24.—**Manchester.**—PAINTING.—The Paving, Sewering, and Highways Committee invite tenders for painting various bridges over the Rochdale Canal and the River Medlock. Specification and form of tender may be obtained on application at the City Surveyor's Office, Town Hall, Manchester, on payment to the City Treasurer of one guinea. All cheques or postal orders to be made payable to the order of "The Corporation of Manchester." Tenders, enclosed in the official envelope, and addressed to the Chairman of the Paving, etc. Committee, to be delivered at the City Surveyor's Office not later than 10 a.m., September 24.

SEPTEMBER 25.—**Leyton.**—PAINTING.—The Leyton U.D.C. invite tenders for the painting work required to be done to the outside of the Town Hall and Technical Institute, High-road, Leyton; and greenhouse in Oliver-road. Specification and form of tender and other particulars may be obtained from Mr. William Dawson, M.Inst.C.E., the Surveyor to the Council, at his offices, Town Hall, Leyton, between 10 and 4 (10 and 12 on Saturdays). Sealed tenders (in special endorsed envelopes supplied with the forms) must be delivered at the meeting of the council, to be held at the Town Hall, Leyton, on September 25, at 7 o'clock p.m.

SEPTEMBER 26.—**Hull.**—PAINTING, ETC.—The Corporation invite tenders for the cleansing, painting, etc., required at the new Central Police-station, Alfred Gelder and Parliament streets. Forms of tender and other particulars may be obtained from Mr. Joseph H. Hirst, City Architect, Town Hall, Hull. Tenders, endorsed "Tender for Cleansing and Painting New Central Police-station," are to be addressed to the Chairman of the Station House Sub-Committee, and delivered at the Town Clerk's Office, Hull, before 10 o'clock on September 26.

SEPTEMBER 26.—**Manchester.**—PAINTING.—The Manchester Guardians of the Poor are prepared to receive tenders for the painting of the Poor Law Offices and the Workhouse in New Bridge-street, Manchester. Specifications may be obtained at the office of Mr. A. J. Murgatroyd, architect, 23, Strutt-street, Manchester, on payment of a deposit of 10s. 6d. Sealed tenders, endorsed "Painting at New Bridge-street," to be delivered to Mr. James Macdonald, Clerk to the Guardians, at the Poor Law Offices, New Bridge-street, Manchester, not later than 3 p.m. on September 26.

SEPTEMBER 27.—**Canterbury.**—PAINTING.—Tenders are invited for painting the exterior of the buildings of the Kent and Canterbury Hospital. The specification can be seen at the hospital, and tenders under sealed cover should be delivered to A. J. Lancaster, Secretary, not later than September 27.

SEPTEMBER 27.—**Darlington.**—PAINTING, ETC.—The Corporation invite tenders for painting, etc., the outside of the Fever Hospital. Specification may be seen, and bill of quantities obtained, on application at the offices of Mr. George Winter, Borough Surveyor, Town Hall. Tenders, endorsed "Tender for Painting at Hospital," to be sent to Mr. Hy. G. Steavenson, Town Clerk, on or before September 27.

OCTOBER 1.—**Hull.**—PAINTING, ETC.—The Guardians of the Sculcoates Union invite tenders for painting, etc., at the Relief Station, St. George's-road, Hull. Forms of tender and all particulars can be obtained, or will be sent by post, on application to Mr. J. H. Wild, solicitor, Clerk to the Guardians, Union Offices, Harley-street, Hull, to whom tenders must be sent not later than 10 o'clock a.m., October 1.

* OCTOBER 1.—**Marylebone-road, W.**—PAINTING, ETC.—The St. Marylebone Guardians invite tenders for outside painting and repairing works at the Houseless Poor Wards, 86, East-street, Marylebone-road, W. Specifications, forms of tender may be obtained between September 21 and 25, on application to Mr. A. Saxon-Snell, F.R.I.B.A., 22, Southampton-buildings, W.C. Tenders, sealed and endorsed "Tender for Outside Painting Works, etc., Houseless Poor Wards," to be addressed and delivered to the Clerk to the Guardians, Northumberland-street, Marylebone-road, W., on or before 10 o'clock a.m., October 1.

* OCTOBER 3.—**Winchmore Hill.**—CLEANING AND PAINTING.—The Metropolitan Asylums Board invite tenders for external and internal cleaning and painting works at the Northern Convalescent Fever Hospital, Winchmore Hill, N., in accordance with specification prepared by Mr. W. T. Hutch, Engineer-in-Chief. Specification, conditions of contract, bills of quantities, and form of tender may be inspected at the office of the Board, Embankment, E.C., and bills of quantities and forms of tender can then be obtained on payment of 1*l.* Tenders, addressed as noted on the form, to be delivered at the office of the Board before 10 a.m., October 3.

ROADS, SANITARY, AND WATER WORKS.

SEPTEMBER 24.—**Farnham.**—ROAD WORKS.—Farnham U.D.C. invite tenders for the levelling, draining, channelling, kerbing, paving, metalling, and making good Adam's Park-road. Plans and specifications may be seen at the office of the Council's Surveyor, South-street, Farnham, Surrey, where the bill of quantities and forms of tender can be obtained any morning between the hours of 9 and 10. Sealed tenders, endorsed "Street Works" on

the outside cover, to be delivered to Mr. Richard Mason, solicitor, Clerk to the Council, 93, West-street, Farnham, on or before 4 p.m. on September 24.

SEPTEMBER 24.—**Halifax.**—PRIVATE IMPROVEMENT WORKS.—The Highways Committee of the Halifax Corporation invite tenders for the execution of private improvement works in a portion of the road between Bank Top Inn and the land belonging to the Lancashire and Yorkshire and Great Northern Joint Railway. Plans and specifications may be seen, and forms of tender obtained, on application to Mr. James Lord, C.E., Borough Engineer, Town Hall, Halifax, upon payment of 1*l.* Tenders, endorsed "Road Behind Bank Top Inn," must be sent to Mr. Keighley Walton, Town Clerk, on or before September 24.

SEPTEMBER 24.—**Ilford.**—ROAD WORKS.—Ilford U.D.C. invites tenders for levelling, metalling, channelling, paving, kerbing, and making good Glencoe-avenue, Eton-road (part of), Oxford-road, Francis-avenue, Francis-road, Elizabeth-road, and Park-road (part of). Plans and specifications may be seen, and form of tender obtained, on application to Mr. H. Shaw, A.M.I.C.E., Surveyor to the Council, Town Hall, Ilford, on payment of a deposit of 2*l.* 2s. Sealed tenders, endorsed "Tender for Private Street Works," must be sent to Mr. John W. Benton, Clerk, Town Hall, Ilford, on or before September 24.

SEPTEMBER 25.—**Redcar.**—PAVING, LEVELLING, ETC.—The Redcar U.D.C. invite tenders for levelling, paving, and making the back and side streets between Hanson-street and Soppett-street, Redcar. Plans and specifications can be seen at the Council Offices, 2, West-terrace, Redcar, on application to Mr. James Howcroft, the surveyor. Tenders, marked "Private Improvements," must be sent to Mr. Alfred H. Sill, Clerk to the Redcar U.D.C., on or before September 25, at 12 o'clock noon.

SEPTEMBER 25.—**Runcorn.**—PATHS.—The U.D.C. of Runcorn invite tenders for excavating, filling up, and forming paths and asphalting same at the Runcorn Cemetery. Particulars may be obtained, and plans seen, at the office of the surveyor and water engineer, Mr. James Wilding, between 9 and 10 a.m. and 2 and 3 p.m., except Saturdays. Tenders to be delivered to Mr. E. Marshall, Secretary, Town Hall, Runcorn, and addressed to the Chairman of the Cemetery Committee, endorsed "Tender for Cemetery Paths," not later than September 25.

SEPTEMBER 25.—**Tynemouth.**—STREET WORKS.—Tenders are invited for executing the following: (1) Paving in Windemere-terrace, and in back lanes north, south, and east of Lansdowne-terrace, North Shields. (2) Paving, etc., in Tynemouth-road, North Shields. Plans and specifications may be seen at the office of John F. Smillie, Borough Surveyor, to whom sealed and endorsed tenders are to be sent not later than 12 noon on September 25.

SEPTEMBER 26.—**Stapleford.**—ROAD WORKS.—Stapleford R.D.C. invite tenders for the completion of Bailey-street and Wellington-street, in the parish of Stapleford. Plans and specifications can be inspected at the office of Mr. F. R. Hawley, Surveyor of the Council, Wood-street, Ilkeston. Tenders marked "Stapleford streets" must be delivered to Mr. Frederic Wm. Fox, Clerk to the Council, Bank Chambers, Beastmarket Hill, Nottingham, on or before September 26.

SEPTEMBER 27.—**Bamford.**—WATER SUPPLY.—The Chapel-en-le-Frith R.D.C. invite tenders for providing and laying of about 1,300 yds. of 3-in. cast-iron pipes, together with the construction of a brick-collecting chamber, and other works connected therewith, at Bamford, Derbyshire. Drawings may be seen, and bills of quantities, specification, and form of tender obtained, on application to the Council's Engineers, Messrs. Swann & Brady, Town Hall, Chapel-en-le-Frith, Stockport, on payment of 1*l.* Tenders to be delivered on or before noon, September 27, endorsed "Tenders Bamford Water," and addressed to Mr. John Burton Boycott, Clerk to the Council, Chapel-en-le-Frith.

SEPTEMBER 27.—**Leamington Spa.**—ROAD WORKS.—The Corporation of Royal Leamington Spa invite tenders for making a short length of roadway. Plans and specification may be seen at the office of their Engineer, at the Town Hall. Tenders, addressed to Mr. Leo. Rawlinson, Town Clerk, Town Hall, Royal Leamington Spa, and endorsed "Tender for Road Making," are to be sent in before noon on September 27.

SEPTEMBER 28.—**Birmingham.**—PRIVATE STREET WORKS.—The Public Works Committee invite tenders for the construction of private street works, including road and sewer construction in Mona-road (off Kingston-road) and Green-street (off Garrison-street). The drawings and specifications may be inspected, and quantities and forms of tender obtained, on deposit of 1*l.*, at the office of Mr. Henry E. Stilgoe, M.Inst.C.E., City Engineer and Surveyor, Council House, Birmingham, where separate tenders for each road are to be sent on or before September 28, endorsed "Tender for Private Street Works."

SEPTEMBER 28.—**Hull.**—ROAD WORKS.—The Corporation invite tenders for paving with concrete and draining certain backways to the south of Spring Bank West and west of Boynton-street. Forms of tender and other particulars may be obtained from Mr. A. E. White, M.Inst.C.E., City Engineer, Town Hall, Hull. Tenders, endorsed "Tender for Backways," are to be addressed to the Chairman of the Works Committee, and delivered at the Town Clerk's Office before noon on September 28.

SEPTEMBER 29.—**Leeds.**—ROAD WORKS.—The Highways Committee invite tenders for making asphalte footpaths, covering the existing pitched foundation of the carriageway with broken granite, and laying channels in Allerton Drive, Chapeltown. Forms of tender and bills of quantities may be obtained, and copies of the documents forming the contract inspected, on application at the Highways Office, 155, Kirkstall-road. Sealed tenders, endorsed "Tender for Private Street Works," and addressed to the Highways Committee, must be delivered at the Town Clerk's Office, Town Hall, Leeds, not later than 10 a.m. on September 29.

OCTOBER 1.—**East Grinstead.**—PRIVATE STREET WORKS.—East Grinstead U.D.C. invites tenders for the sewering (sewage and surface water) and contingent works in Morton-road, and parts of Coronation-road and Stockwell-road. The drawings and specification may be seen, and the form of tender obtained, from Mr. W. E. Woollam, Engineer and Surveyor to the Council, during the usual office hours on depositing postal order value 1*l.* Tenders, endorsed "Tender for Roads, Sunnyside," must be sent to Mr. E. P. Whitley Hughes, Clerk to the Council, on or before October 1.

OCTOBER 2.—**Hove.**—BRICK SEWER, ETC.—The Hove Council invite tenders for constructing a brick sewer in Langdale-road; concrete and stoneware pipe sewers in New Church-road and Wish-road; and other works. Plans, specification, and form of contract may be seen, and bills of quantities and form of tender obtained, at the office of the Borough Surveyor (Mr. Hugh Hamilton Scott), on payment of 5*l.* 5s. Tenders, on the forms provided, endorsed "Tender for Main Drainage Works, Contract No. 2," addressed to Mr. H. Endacott, Town Clerk, Town Hall, Hove, will be received up to 6 o'clock on October 2.

OCTOBER 2.—**Lewisham.**—ROAD WORKS.—The Borough Council invite tenders for kerbing, channelling, and metalling the roadway and paving the footpaths with artificial stone (in separate contracts) of Saravia-road, Lewisham. The plans and specifications may be seen, and forms of tender obtained, at the Town Hall, Catford (Surveyor's Department), and copies of the specification may also be had on payment of 5s. in each case. The tenders must be on forms issued by the Council, enclosed in an envelope, sealed, and endorsed "Tender for Saravia-road," and must be delivered by 4 o'clock on October 2, 1906, at the Town Hall, Catford, S.E.

OCTOBER 2.—**Moreton-in-the-Marsh.**—SEWAGE WORKS.—Chipping Campden R.D.C. invite tenders for the provision, laying, and jointing of cast-iron and stoneware pipe sewers, together with manholes and lampholes, construction of pump well, engine-house, liquefying tanks, and other incidental works, in accordance with the drawings and specification, which may be seen, and bills of quantities and form of tender obtained, at the offices of the engineers, Messrs. Willcox & Raikes, 63, Temple-row, Birmingham, on payment of a deposit of 3*l.* 3s. Sealed tenders, in envelopes supplied, endorsed "Moreton-in-the-Marsh Sewerage—Contract No. 1," to be delivered to Mr. Oliver H. New, Clerk to the Council, Chipping Campden, not later than 12 o'clock noon on October 2.

OCTOBER 2.—**Walsall.**—SEWAGE WORKS.—Brownhills U.D.C. invite (Contract No. 1) tenders for the construction of detritus tanks, bacteria filters, and other incidental works in connexion therewith, at the Mosspits Sewage Disposal Works, near Walsall. Plans and specifications may be seen at the offices of the engineers, Messrs. Willcox & Raikes, 63, Temple-row, Birmingham, from whom bills of quantities and form of tender may be obtained on payment of a deposit of 2*l.* 2s. Sealed tenders in envelopes supplied, endorsed "Mosspits Sewage Disposal Works," to be delivered to Mr. T. H. Stanley, Clerk to the Brownhills U.D.C., 35, Bridge-street, Walsall, not later than October 2.

OCTOBER 3.—**Lewisham.**—WOOD PAVING WORK.—The Council invites tenders for supplying and laying creosoted deal blocks in the roadway in High-road, Lee, from High-street, Lewisham, to Lee Green; also for repaving with the same material a portion of the roadway in Tranquil Vale, Blackheath, particulars of which are set out in the specifications and forms of tender. The plans, specifications, and conditions may be seen, and forms of tender obtained, at the Town Hall, Catford (Surveyor's Department). The tenders, enclosed in an envelope, sealed and endorsed "Tender for Wood Paving in ——," must be delivered by 12 o'clock on October 3, at the Town Hall, Catford, S.E.

* OCTOBER 3.—**Tooting.**—TAR PAVING, ETC.—Metropolitan Asylums Board invite tenders for new tar paving and repairs to existing paving at Tooting Bec Asylum, Tooting, S.W. Specification, condition of contract, and form of tender may be inspected at the Board's Office, Embankment, E.C., on and after September 24. Tenders, addressed as noted on form, to be delivered at the Board's Office not later than 10 a.m., October 3.

* OCTOBER 4.—**Bromley.**—ROAD MAKING.—The Councils of Bromley, Beckenham, etc., invite tenders for certain works of sewering, levelling, paving, metalling, channelling, and making good Hayes-road. Plans and sections may be seen, and specifications, bills of quantities, and forms of tender obtained, at the office of the Borough Engineer, Bromley, Kent, on payment of 1*l.* 1s. Tenders, endorsed "Tender for Hayes-road," must be delivered to the Clerk of the Bromley R.D.C., Park House, Beckenham-lane, Bromley, Kent, not later than October 4.

OCTOBER 6.—**Skipton.**—SEWAGE DISPOSAL WORKS.—Contract No. 1.—The Skipton U.D.C. invite tenders for the construction of detritus tanks, sedimentation tanks, continuous filters, the laying out of about twenty acres of land, the construction of a storm-water bed and main, and other works in connexion with their sewage disposal works. The drawings may be seen, and a copy of the specification, schedule of quantities, conditions of contract, and form of tender obtained, on application to the Council's Engineer, Mr. John Mallinson, Town Hall, Skipton, on payment of two guineas. Sealed tenders, in envelopes to be supplied, are to be delivered to Mr. Richard Wilson, Clerk to the Council, not later than October 6.

OCTOBER 8.—**Market Harborough.**—STREET WORKS.—The Market Harborough R.D.C. invite tenders for the construction and making-up of the following streets in the Parish of Kibworth Beauchamp, viz.:—Gladstone-street, Dover-street, Buller-street, Kimberley-street, White-street, and Rosebery-avenue. Plans may be seen at the offices of the Council, and at the offices of the Engineers, Messrs. Everard, Son, & Pick, 6, Millstone-lane, Leicester, from whom quantities and form of tender may be obtained upon payment of 2*l.* 2s. Sealed tenders to be sent to Mr. Charles Burgoine, Clerk to the Council, Market Harborough, not later than 10 o'clock in the forenoon of October 8, endorsed "Tender for Kibworth Roads."

OCTOBER 10.—**Stockport.**—CONSTRUCTION OF SEWERS, ETC.—The Highways and Sewers Committee invite tenders for the manual and team labour and materials required in the construction of about 1,360 lin. yds. of egg-shaped sewers, varying in size from 3 ft. by 2 ft. to 4 ft. by 2 ft. 8 in.; 100 lin. yds. of cast-iron pipe sewers, 15 in. and 21 in. in diameter, and 6,120 lin. yds. of stoneware pipe sewers, varying from 12 in. to 36 in. diameter; together with all manholes and ventilators; the construction of a small detritus tank and screening chamber, and other incidental works for the sewerage of the added areas of Cheadle and Bramhall. Plans, sections, and details may be seen, and conditions, specifications of works and materials, bills of quantities, form of tender, etc., may be obtained, from Mr. John Atkinson, A.M.Inst.C.E., Borough Surveyor, Borough Surveyor's Office, Stockport, on payment of a deposit of 3*l.* 3s. Tenders, addressed "The Borough Surveyor, Stockport," sealed and endorsed "Tender for Sewers in Added Areas of Cheadle and Bramhall," to be delivered at or before noon on October 10.

NO DATE.—**Aboyne.**—ROAD WIDENING.—Estimates wanted for widening the public road opposite Waterside, on Glen Tana Estate. Plans and specifications to be seen with Mr. J. Milne, Road Surveyor, Aboyne.

* NO DATE.—**Wealdstone.**—ROAD AND SEWERS.—Tenders required for about 1,050 ft. of road and sewers at Wealdstone. Specifications, plans, and sections can be seen at the offices of Messrs. Allen & Hoar, surveyors, 283, West End-lane, N.W.

STONE, MATERIALS, AND STORES.

SEPTEMBER 24.—**Sevenoaks.**—ROAD MATERIAL.—The Sevenoaks U.D.C. invite tenders for 2,200 yds. of clean local stone, or any less quantity, according to the specification prepared by the Surveyor to the Council, to be delivered otherwise than by traction engines, on or before October 31, at the various depôts within their district. Sealed tenders to be addressed to Mr. Herbert J. Thompson, Clerk to the Council, Urban Council Offices, Sevenoaks, and endorsed "Tender for Road Metal, etc.," and delivered on or before September 24.

SEPTEMBER 24.—**Surbiton.**—MACADAM.—The U.D.C. of Surbiton invite tenders for the supply and delivery of Rhenish columnar basalt macadam. Specification and forms of tender can be obtained on application to the Surveyor, at the District Council Offices, Surbiton. Tenders, enclosed in sealed envelopes, endorsed "Tender for Basalt Macadam," and addressed to Mr. James Bell, Clerk to the Council, District Council Offices, Surbiton, must be delivered at or before noon on September 24.

SEPTEMBER 25.—**Sheerness.**—ROAD MATERIALS.—Sheerness U.D.C. invite tenders for the following:—(1) Basalt or granite, 350 tons, broken to pass through a 2-in. ring; (2) good clean pit flints, 300 yds. broken to pass through a 2-in. ring; (3) basalt or granite chippings, 20 tons; (4) good clean hoggin for binding purposes, 300 yds. To be delivered in barges alongside the pier at Sheerness at contractor's cost. The Council will unload and cart and pay pier dues. Samples of the materials must be sent to or left with the Surveyor to the Council, Mr. T. F. Berry, and sealed tenders, on forms supplied, stating price per yard or ton, endorsed outside "Tender for Road Material," must be delivered or sent to Mr. Vincent H. Stallon, Clerk of the Council, Council Offices, Trinity-road, Sheerness, before noon on September 25.

SEPTEMBER 26.—**Glasgow.**—STEEL RAILS AND FISHPLATES.—The Corporation of Glasgow invite tenders for the supply of 1,000 to 2,000 tons of rails B.S. Section No. 5, 150 tons B.S. Section No. 5c, and 20 tons fishplates for same. Specification, with form of tender and drawings, can be obtained on application to Mr. James Dalrymple, General Manager, 46, Bath-street, Glasgow, and sealed tenders, endorsed "Tramways—Tender for Steel Rails," must be lodged with Mr. A. W. Myles, Town Clerk, City Chambers, Glasgow, not later than 10 a.m., September 26.

SEPTEMBER 26.—**Halifax.**—GRANITE AND DROSS.—Southowram U.D.C. invite tenders for the supply of granite and dross as follows:—150 tons of granite, to Brighouse Station; 50 tons of granite, to Elland Station; 150 tons of dross, to Brighouse Station; 150 tons of dross, to North Bridge Station, Halifax; 200 tons of dross, to Hipperholme Station. Tenders should be sent, along with sample, carriage paid, to Mr. Councillor J. S. Hartley (Messrs. Hartley & Kaye, North Bridge Stone Wharf, Halifax), and should state the price per ton, at which the material will be delivered at the above-named stations respectively, in such quantities as may be desired by the Surveyor to the Council. All tenders and samples must be delivered not later than September 26, and must be endorsed "Tenders for Granite, etc."

SEPTEMBER 26.—**Newport.**—TIMBER.—Bath and West and Southern Counties Society invite tenders for supplying the timber for the show-yard buildings of the show at Newport (Mon.). Specifications may be obtained of the Secretary, Thos. F. Plowman, 3, Pierrepont-street, Bath, to whom tenders must be sent not later than September 26.

SEPTEMBER 27.—**Grays.**—GRANITE, ETC.—The Grays Thurrock U.D.C. invite tenders for the supply and delivery to the Town Wharf, Grays, of about 600 tons of 1½-in. granite or basalt macadam and 150 tons of ½-in. chippings of the same material. Tenders, which must be on the form to be obtained, with specification, from the Council's Surveyor, at his office, High-street, Grays, and be accompanied by a sample of the material tendered for, are to be delivered to Messrs. Hatten & Asplin, Clerks of the Council, District Council Offices, Grays, by noon on September 27, endorsed "Tender for Macadam."

SEPTEMBER 27.—**Lambeth.**—PAVING STONE.—The Lambeth Metropolitan Borough Council invites

tenders for the supply of 12,000 super. ft. of new 2½-in. York stone paving, "Silex" Brand. Forms of tender can be obtained from Mr. Henry Edwards, C.E., Borough Engineer, 346, Kennington-road, S.E. Sealed tenders, endorsed "Tender for York Stone Paving," must be delivered at the Lambeth Town Hall, Kennington-green, S.E., not later than 12 o'clock noon on September 27.

SEPTEMBER 29.—**Durban, Natal.**—STONEWARE SEWERAGE PIPES.—The Corporation of Durban invite (from manufacturers only) tenders for the supply and delivery ("free on board") of two miles each of 6 in., 7 in., and 8 in. diameter stoneware sewerage pipes. Specifications can be obtained from Mr. W. H. Radford, C.E., Albion-chambers, Nottingham, Consulting and Representative Engineer to the Corporation, on deposit of 1*l.* 1*s.* Sealed and endorsed tenders must be delivered to Messrs. Webster, Steel, & Co., Agents to the Durban Corporation, 5, East India-avenue, Leadenhall-street, London, E.C., on or before September 29. The lowest or any tender will not necessarily be accepted.

✱ SEPTEMBER 29.—**Paddington.**—SHINGLE.—The Borough Council of Paddington invite tenders for supply of fine crushed Thames shingle, granite chippings, or other material for strewing on carriage ways. Forms of tender, etc., to be obtained on application to the Borough Surveyor, Town Hall, Paddington, W., between 10 p.m. and 4 p.m. (Saturdays, 10 a.m. and 1 p.m.). Tenders, sealed and endorsed "Shingle," addressed to the Town Clerk, as above, to be delivered together with samples, not later than September 29.

OCTOBER 1.—**Sandgate.**—HIGHWAY MATERIALS.—The Sandgate U.D.C. invite tenders for the supply of various highway materials, to be delivered at the cost of the contractor, on or before November 30 next. Forms of tender may be had upon application to Mr. J. Shere Atkinson, Clerk to the Council, Council Offices, 51, High-street, Sandgate, to whom tenders must be sent, marked "Tender for Highway Materials," not later than October 1

✱ OCTOBER 8.—**London.**—STORES.—The Metropolitan Railway Company invite tenders for supply of general stores during twelve months ending October 31, 1907. Application for form of tender to be made after September 27. Samples and patterns of goods may be seen at the office of the Company's Storekeeper, adjoining Neasden Station, N.W., from October 1 to 6 inclusive. Tenders, on forms supplied and endorsed "Tender for ——," must reach the Secretary, 32, Westbourne-terrace, W., not later than 10 a.m., October 8.

Auction Sales.

Nature and Place of Sale.	By whom Offered.	Date of Sale.
*DEALS, BATTENS, ETC.—Great Hall, Winchester House, Old Broad-street, E.C.	Churchill & Sims	Sept. 26
*BRICKMAKING PLANT AND MACHINERY, CATFORD—On the Premises	J. T. Skelding	Sept. 27
*FREEHOLD BUILDING LAND, SHREWSBURY—The County Mart, Shrewsbury	Wm. Hall, Wateridge, & Owen	Sept. 28
*JOINERY WORKS HENRY-STREET, GRAY'S-INN-ROAD	May & Rowden	Oct. 3
*BUILDERS' MERCHANT'S STOCK, ETC.—At Frogmore Wharf, Frogmore, Wandsworth, S.W.	J. T. Skelding	Oct. 9
*FREEHOLD ESTATE, ALTHORNE, ESSEX—At the Mart	Cockett & Henderson	do.
*ANCASTER HOUSE ESTATE—At the Mart	Chancellor & Sons	October.

PATENTS.—*Continued from page 355.*

3,649 of 1906.—E. C. R. MARKS (Platt, Baker Company): *Detachable Hinge for Windows and the like.*

This relates to a detachable hinge for windows and the like of the type wherein hinged brackets are adapted to slide over projections arranged respectively upon the fixed frame and the sliding sash, and a device upon the fixed frame for locking the bracket in position.

6,872 of 1906.—THE PERFECTOR WINDOW COMPANY, LTD., and W. HIGSON: *Pivoted Sash and Casement Windows.*

This relates to the application to the movable part of a pivoted sash and casement window of a semi-circular bar or plate, which is attached to the movable part of the pivot, and is provided with a number of holes, and consists in the combination therewith of a plate which has one hole, and is attached to the fixed part of the window.

7,076 of 1905.—P. LECHLER: *Radiators and like Heating Apparatus.*

This relates to a heating apparatus having a heating-chamber or shaft the cross-section of which decreases as its distance from the heating source increases, ribs on the shaft, and means for heating and for discharging the combustion gases from the shaft.

9,392 of 1906.—D. J. A. CONCE: *Fire Bars for Stoves, Furnaces, and the like.*

This relates to fire bars for stoves and the like, and consists in constructing each fire bar of two members placed together so that a space exists between their inner facing vertical surfaces, and is characterised by one member having a number of projections proceeding from its inner vertical surface and extending upwards at a distance therefrom, each projection presenting a square upper face. The longitudinal edge of the member is divided by slots into rectangular surfaces, the opposite member being similarly formed with inward projections passing, when the two first members are placed together, between the projections of the first member, a number of fire bars so constructed presenting, when assembled, an upper supporting surface for the fuel, composed of squares like a chess-board, with spaces around each square for the passage of the air and for the falling through of the ashes and refuse.

13,383 of 1906.—H. E. VANCE: *Slats for Constructing Fireproof Curtains, Screens, Shutters, Doors, and the like.*

This relates to a fireproof blind or curtain, and consists of a metallic slat provided at its edge with a hook to which the heat retardent material is applied on both sides, the material on one side extending over the back of the hook, while the material on the other side does not extend to the hook.

16,648 of 1905.—G. L. MOUCHEL: *Armoured Concrete Piles.*

This relates to an armoured concrete pile, comprising a wall of concrete rods with metal disposed longitudinally therein, said rods being securely tied together with a hole throughout the whole or greater part of its length, and without any diaphragm or external metal casing, said hole having a cross-sectional area larger than that of the rod for passing water therethrough as a means for sinking the pile.

16,706 of 1906.—E. G. PERROT: *Reinforced Concrete Structures.*

This relates to reinforcing means for a cementious body, comprising longitudinal main bars or members formed of metallic structural elements, longitudinally extending plates connecting said bars, said bars being separated at other points, and transverse minor elements attached to said longitudinally extending elements where not engaged by said longitudinal plates, said minor elements also connecting parallel longitudinal bars and holding the same in position transversely within the cementitious body.

24,088 of 1905.—J. GRANICH: *Casting Moulds Used for Connecting and Luting Stoneware Pipes.*

This relates to a casting mould for connecting and luting stoneware pipes, consisting of two semi-circular parts forming a ring, the inner surface of which is of such a form that, when mounted on the pipes, a hollow space is formed between the ring and the flange of the adjacent pipe, means to hinge the two parts of the ring on one side, and means to temporarily fasten them on the other side.

1,715 of 1906.—J. S. PULLAN and W. H. MANN: *Brick Moulding or Pressing Machines.*

This relates to a brick moulding or pressing machine in which the pressing plunger is actuated through the medium of a screw, and consists in the combination with the pressing plunger of an internal die or loose plate mounted within a skeleton plate attached to the under face of the plunger, a vertically sliding collar located on the lower end of the actuating screw, and having oppositely situated inclined notches formed therein, and oppositely situated arms pivoted to the plunger, and formed with inwardly directed hooked ends adapted to engage within the inclined notches in the collar. The arrangement is such that, on the screw being actuated, the plunger and internal die are moved down simultaneously until the skeleton plate of the plunger enters the mould to a predetermined distance, when the pivoted hooked arms are caused to move outwardly from the collar into engagement with recesses formed in the press frame to retain the plunger in the down position, and allow the screw to carry the internal die further down within the mould to spread the clay outward to the underside of the skeleton plate, and produce a brick of a standard thickness on its outer edges.

3,182 of 1906.—DR. B. ALEXANDER-KATZ: *Process of Manufacturing Artificial Stone.*

This relates to a process of manufacturing artificial stones from fibrous materials such as asbestos and binding agents such as a slowly-binding cement, in which, by utilising the well-known filtering properties of the asbestos, a mixture of asbestos cement, and but a small quantity of water, is freed from water, felted, and shaped by means of a filter press or filtering drums.

13,348 of 1906.—M. REICH: *Scaffolding.*

This relates to a scaffolding adjustable in vertical direction, consisting of a post cross-shaped in cross-section, guarded in a vertical tube, two angle-irons fixed in the upper end of said tube to form with their parallel shanks guards for the lateral arms of the post, the two shanks of the angle-irons being pressed together to form one flat piece at the part projecting from the upper end of the tube, the said part of the angle-irons as well as the lateral arms of the post being provided with equidistant holes for the reception of the bolts connecting the post with the tube, the post having in its upper end vertical incisions for the reception of the vertical shanks of the L-irons forming the support for the planking, said shanks having equidistant holes for the reception of screw-bolts, which secure the bars in their position.

4,228 of 1906.—A. D'HAVE: *Arrangement of Strengthening Wires for Building in Concrete and the like.*

This invention relates to the construction of floors of strengthened concrete, and consists in the arrangement of wires and the distribution of the weight towards the support of the beams by means of strengthening elements which have four points of attachment, and have the form of elongated letter X. The invention further consists in the construction of the beams, comprising the "compression" and "tension" bars for supporting a floor of the type described, and in the use of cables and of straps or twisted wires to connect the "tension" and compression bars, the cables running through the whole length of the beams, and following the line of bending moment due to the weight of the supported structure.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

September 4.—By G. H. MASTERMAN & CO.	
St. Pancras.—21, Charrington-st., u.t. 16¾ yrs., g.r. 5*l.* 5*s.*, e.r. 52*l.*	£255
September 6.—By MADDISON, MILES, & MADDISON (at Bungay).	
Bungay, Suffolk.—Broad-st., freehold stabling and warehouse, p.	120
Needham, Norfolk.—A freehold holding, 1 a. 0 r. 24 p., y.r. 7*l.*	120
Bedingham, Norfolk.—Two cottages and 0 a. 2 r. 33 p., f.	130
A freehold house and 0 a. 2 r. 27 p.	140
September 8.—By H. J. WAY & SON (at Newport).	
Newchurch, Isle of Wight.—"Langbridge Farm," 82 a. 1 r. 28 p., f., y.r. 160*l.*	3,700
September 11.—By BRADSHAW, BROWN, & CO.	
Cranham, Essex.—"Crouch House" and farm, 87 a. 2 r. 37 p., f. (in lots)	7,425
By OSBORN & MERCER.	
Walthamstow.—52, Grosvenor Park-rd., f., y.r. 27*l.*	350
Tottenham.—12, 13, 14, 15, and 16, Chesnut-rd., f., w.r. 135*l.* 4*s.*	1,320
By MADDISON, MILES, & MADDISON (at Yarmouth).	
Yarmouth.—10 and 11, Row 24, Market-pl. (s.), f., y.r. 16*l.*	135
1, Row 48, North Quay (s.), f., y.r. 7*l.*	120
5, Wordsworth-pl., and cottage adjoining, f.	135
18, Howard-st. North (s.), f., y.r. 17*l.* 10*s.*	300
21, Kent-sq., f., y.r. 12*l.*	265
37 and 38, Well-st., u.t. 18 yrs., g.r. 13*s.*	190
5, 6, and 7, Telegraph Cottages, f.	320
9, Queen's-pl., f., y.r. 13*l.*	128
Gorleston, Suffolk.—The "Folly," f., y.r. 10*l.*	248
By SPELMANS' (at Norwich).	
Norwich.—Back of the Inns, The "Red Rose," p.h., f., p.	940
25 and 27, Waterloo-rd. (s.), f., y.r. 16*l.*	225
Sept. 12.—By FULLER, MOON, & FULLER.	
Norwood.—Durham Villas, f.g. rents 26*l.*, reversion in 57 yrs.	520
Woodcote-pl., f.g.r. 40*l.*, reversion in 56 yrs.	895
Horley, Surrey.—"Lincoln Lodge" and 37 acres, f., y.r. 80*l.*	2,000

By DOUGLAS YOUNG & Co.

South Kensington.—94, Fulham-rd. (s.), u.t. 44½ yrs., g.r. 20*l.*, y.r. 150*l.* £1,800

Sept. 13.—By W. A. HEAD.

Camberwell.—2 to 20 (even), Dugdale-st., u.t. 16 yrs., g.r., etc., 175*l.*, w.r. 430*l.* 0s. 325

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; p. for possession; e.r. for estimated rental; w.r. for weekly rental; q.r. for quarterly rental; y.r. for yearly rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; la. for lane; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; av. for avenue; gdns. for gardens; yd. for yard; gr. for grove; b.h. beerhouse; p.h. for public-house; o. for office; s. for shops; ct. for court.

TERMS OF SUBSCRIPTION.

"THE BUILDER" (Published Weekly) is supplied DIRECT from the Office to residents in any part of the United Kingdom at the rate of 19s. per annum (52 numbers) PREPAID. To all parts of Europe, America, Australia, New Zealand, India, China, Ceylon, etc., 26s. per annum.

Remittances (payable to J. MORGAN) should be addressed to The Publisher of "THE BUILDER," Catherine-street, W.C.

SUBSCRIBERS in LONDON and the SUBURBS, by prepaying at the Publishing Office 19s. per annum (52 numbers) or 4s. 9d. per quarter (13 numbers), can ensure receiving "The Builder" by *Friday Morning's Post*.

MEETINGS.

FRIDAY, SEPTEMBER 21.

Royal Sanitary Institute (Lectures for Sanitary Officers).—Dr. G. Newman on "Duties of a Sanitary Inspector"—III. 7 p.m.

SATURDAY, SEPTEMBER 22.

Junior Institution of Engineers.—Visit the Knight, Bevan, and Sturge Portland Cement Works of the Associated Portland Cement Manufacturers. Train leaves Charing Cross at 1.25 p.m. for Northfleet.

Institute of Sanitary Engineers.—Visit to Hampton Sewage Works.

MONDAY, SEPTEMBER 24.

Royal Sanitary Institute.—Dr. A. Wellesley Harris on "Infectious Diseases." 7 p.m.

WEDNESDAY, SEPTEMBER 26.

Royal Sanitary Institute.—Dr. A. Wellesley Harris on "Methods of Disinfection." 7 p.m.

FRIDAY, SEPTEMBER 28.

Royal Sanitary Institute.—Dr. A. Wellesley Harris on "Elementary Statistics." 7 p.m.

SATURDAY, SEPTEMBER 29.

Northern Architectural Association.—Students' Sketching Club excursion.

Institute of Sanitary Engineers.—Visit to Engineering and Machinery Exhibition at Olympia.

Incorporated Association of Municipal and County Engineers.—Home district meeting at Windsor. 11 a.m., assemble in the Guildhall; 12 noon, visit to Windsor Castle; 1.30 p.m., luncheon in the Guildhall; 2.30 p.m., drive by brakes to inspect various buildings; 5 p.m., at the Guildhall.

PUBLISHER'S NOTICES.

Nat. Tel., 6112 Gerrard. Telegrams, "The Builder, London."

THE INDEX (with TITLE-PAGE) for VOLUME XC. (January to June, 1906) was given as a supplement with the issue for July 14.

CLOTH CASES for Binding the Numbers are now ready, price 2s. 6d. each; also

READING CASES (Cloth), with Strings price 9d. each

THE NINETIETH VOLUME of "The Builder" (bound), price Twelve Shillings and Sixpence.

SUBSCRIBERS' VOLUMES, on being sent to the Office, will be bound at a cost of 3s. 6d. each.

CHARGES FOR ADVERTISEMENTS.

COMPETITIONS, CONTRACTS, ALL NOTICES ISSUED BY CORPORATE BODIES, COUNTY AND OTHER COUNCILS, PROSPECTUSES OF PUBLIC COMPANIES, SALES BY TENDER, LEGAL ANNOUNCEMENTS, etc., etc.

Six lines or under ..... 6s. 0d.
Each additional line ..... 1s. 0d.

SITUATIONS VACANT, PARTNERSHIPS, APPRENTICESHIPS, TRADE AND GENERAL ADVERTISEMENTS.

Six lines (about fifty words) or under ..... 4s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

Terms for series of Trade advertisements, and for front page and other special positions, on application to the Publisher.

SITUATIONS WANTED (Single-handed—Labour only).

Four lines (about thirty words) or under ..... 2s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

PREPAYMENT IS ABSOLUTELY NECESSARY.

*** Stamps *must not* be sent, but all sums should be remitted by Postal Orders, payable to J. MORGAN, and addressed to the Publisher of "THE BUILDER," Catherine Street, W.C.

Advertisements for the current week's issue are received up to HALF-PAST ONE p.m. on THURSDAY, but "Classification" is impossible in the case of any which may reach the Office after HALF-PAST TWELVE p.m. on that day. Those intended for the Outside Wrapper should be in by TWELVE NOON on WEDNESDAY.

ALTERATIONS IN STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same must reach the Office before TEN o'clock on WEDNESDAY MORNING.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, etc., left at the Office in reply to advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

ADVERTISERS in "THE BUILDER" may have *Replies addressed to the Office*, Catherine Street, Covent Garden, W.C., *free of charge*. Letters will be forwarded if addressed envelopes are sent, together with sufficient stamps to cover the postage. Unused stamps are returned to advertisers the week after publication.

N.B.—The Reply Boxes are not intended for trade lists, circulars, and the like; should these be received, they cannot (if noticed) be forwarded.

AN EDITION Printed on THIN PAPER, for FOREIGN and COLONIAL CIRCULATION, is issued every week.

READING CASES { NINEPENCE EACH. (By post (carefully packed) 1s.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.	
Hard Stocks	1 10 0	per 1000 alongside, in river.
Rough Stocks and Grizzles	1 7 0	,, ,, ,,
Picked Stocks for Facings	2 17 6	,, delivered.
Flettons	1 8 0	,, at railway depôt.
Red Wire Cuts	1 14 0	,, ,, ,,
Best Fareham Red	3 12 0	,, ,, ,,
Best Red Pressed Ruabon Facing	5 0 0	,, ,, ,,
Best Blue Pressed Staffordshire	3 15 0	,, ,, ,,
Do. Bullnose	4 0 0	,, ,, ,,
Best Stourbridge Fire Bricks	3 14 0	,, ,, ,,
GLAZED BRICKS.		
Best White and Ivory Glazed Stretchers	12 0 0	,, ,, ,,
Headers	11 0 0	,, ,, ,,
Quoins, Bullnose, and Flats	16 0 0	,, ,, ,,
Double Stretchers	19 0 0	,, ,, ,,
Double Headers	16 0 0	,, ,, ,,
One Side and two Ends	19 0 0	,, ,, ,,
Two Sides and one End	20 0 0	,, ,, ,,
Splays, Chamferred, Squints	20 0 0	,, ,, ,,
Best Dipped Salt Glazed Stretchers, and Header	12 0 0	,, ,, ,,
Quoins, Bullnose, and Flats	14 0 0	,, ,, ,,
Double Stretchers	15 0 0	,, ,, ,,
Double Headers	14 0 0	,, ,, ,,
One Side and two Ends	15 0 0	,, ,, ,,
Two Sides and one End	15 0 0	,, ,, ,,
Splays, Chamferred, Squints	14 0 0	,, ,, ,,
Second Quality White and Dipped Salt Glazed	2 0 0	,, less than best.
Thames and Pit Sand	7 0	per yard, delivered
Thames Ballast	5 6	,, ,,
Best Portland Cement	27 0	per ton, ,,
Best Ground Blue Lias Lime	19 0	,, ,,

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 11s. 6d. per yard, delivered.
Stourbridge Fireclay in sacks 27s. 0d. per ton at rly. dpt.

STONE.

	s. d.	
BATH STONE—delivered on road waggons, Paddington Depôt	1 6½	per ft. cube
Do. do. delivered on road waggons, Nine Elms Depôt	1 8½	,, ,,
PORTLAND STONE (20 ft. average)—Brown Whitbed, delivered on road waggons, Paddington Depôt, Nine Elms Depôt, or Pimlico Wharf	2 1	,, ,,
White Basebed, delivered on road waggons, Paddington Depôt, Nine Elms Depôt, or Pimlico Wharf	2 2½	,, ,,
	s. d.	
Lancaster in blocks	1 10	per ft. cube, deld. rly. depôt
Beer ,,	1 6	,, ,,
Greenshill ,,	1 10	,, ,,
Darley Dale in blocks	2 4	,, ,,
Red Corsehill ,,	2 2	,, ,,
Closeburn Red Freestone	2 0	,, ,,
Red Mansfield ,,	2 4	,, ,,
YORK STONE—*Robin Hood Quality.*		
Scappled random blocks	2 10	,, ,,
6 in. sawn two sides landings to sizes (under 40 ft. super.)	2 3	per ft. super., ,,
6 in. rubbed two sides ditto, ditto	2 6	,, ,,
3 in. sawn two sides slabs (random sizes)	0 11½	,, ,,
2 in. to 2½ in. sawn one side slabs (random sizes)	0 7½	,, ,,
1½ in. to 2 in. ditto, ditto	0 6	,, ,,
STAIRD YORK—		
Scappled random blocks	3 0	per ft. cube, ,,
6 in. sawn two sides landings to sizes (under 40 ft. super.)	2 8	per ft. super., ,,
6 in. rubbed two sides ditto	3 0	,, ,,
6 in. sawn two sides slabs random sizes)	1 2	,, ,,
2 in. self-faced random flags	0 5	,, ,,
	s. d.	
Hopton Wood (Hard Bed) in blocks	2 0	per ft. cube, deld. rly. depôt.
,, ,, ,, 6 in. sawn both sides landings	2 7	per ft. super. deld. rly. depôt.
,, ,, ,, 3 in. sawn both sides random slabs	1 0	,, ,,
,, ,, ,, 2 in. do.	0 8½	,, ,,

SLATES.

In. In.	£ s. d.	
20×10 best blue Bangor	13 2 6	per 1000 of 1200 at r. d.
20×12 ,, ,,	13 17 6	,, ,,
20×10 first quality ,,	13 0 0	,, ,,
20×12 ,, ,,	13 15 0	,, ,,
16×8 ,, ,,	7 5 0	,, ,,
20×10 best blue Portmadoc	12 12 6	,, ,,
16×8 ,, ,,	6 12 6	,, ,,
20×10 best Eureka unfading green	15 17 6	,, ,,
20×12 ,, ,,	18 7 6	,, ,,

SLATES (*continued*).

In. In.	£ s. d.	
18×10 best Eureka unfading green	13 5 0	per 1000 of 1200 at r.d.
16×8 ,, ,,	10 5 0	,, ,,
20×10 permanent green	11 12 6	,, ,,
18×10 ,, ,,	9 12 6	,, ,,
16×8 ,, ,,	6 12 6	,, ,,

TILES.

	s. d.	
Best plain red roofing tiles	42 0	per 1000 at rly. depôt.
Hip and Valley tiles	3 7	per doz. ,,
Best Broseley tiles	50 0	per 1000 ,,
Do. Ornamental tiles	52 6	,, ,,
Hip and Valley tiles	4 0	per doz. ,,
Best Ruabon red, brown, or brindled do. (Edwards)	57 6	,, ,,
Do. Ornamental do.	60 0	,, ,,
Hip tiles	4 0	per doz. ,,
Valley tiles	3 0	,, ,,
Best Red or Mottled Staffordshire do. (Peakes)	51 9	per 1000 ,,
Do. Ornamental do.	54 6	,, ,,
Hip tiles	4 1	per doz. ,,
Valley tiles	3 8	,, ,,
Best "Rosemary" brand plain tiles	48 0	per 1000 ,,
Best Ornamental tiles	50 0	,, ,,
Hip tiles	4 0	per doz. ,,
Valley tiles	3 8	,, ,,
Best "Hartshill" brand plain tiles, sand-faced	50 0	per 1000 ,,
Do pressed	47 6	,, ,,
Do. Ornamental do.	50 0	,, ,,
Hip tiles	4 0	per doz. ,,
Valley tiles	3 6	,, ,,

WOOD.

BUILDING WOOD.	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	13 10 0	... 15 0 0
Deals: best 3 by 9	13 0 0	... 14 0 0
Battens: best 2½ in. by 7 in. and 8 in., and 3 in. by 7 in. and 8 in.	11 0 0	... 12 0 0
Battens: best 2½ by 6 and 3 by 6	0 10 0	less than 7 in. and 8 in.
Deals: seconds	1 0 0	less than best.
Battens: seconds	0 10 0	,, ,,
2 in. by 4 in. and 2 in. by 6 in.	9 0 0	... 10 0 0
2 in. by 4½ in. and 2 in. by 5 in.	8 10 0	... 9 10 0
Foreign Sawn Boards— 1 in. and 1¼ in. by 7 in.	0 10 0	more than battens.
¾ in.	1 0 0	,,
	At per load of 50 ft.	
Fir timber: best middling Danzig or Memel (average specification)	4 10 0	... 5 0 0
Seconds	4 0 0	... 4 10 0
Small timber (8 in. to 10 in.)	3 12 6	... 3 15 0
Small timber (6 in. to 8 in.)	3 0 0	... 3 10 0
Swedish balks	2 10 0	... 3 0 0
Pitch-pine timber (30 ft. average)	4 0 0	... 4 15 0
JOINERS' WOOD.	At per standard.	
White Sea: first yellow deals, 3 in. by 11 in.	24 0 0	... 25 0 0
3 in. by 9 in.	22 0 0	... 23 0 0
Battens, 2½ in. and 3 in. by 7 in.	16 10 0	... 18 0 0
Second yellow deals, 3 in. by 1 in.	18 10 0	... 20 0 0
,, ,, 3 in. by 9 in.	17 10 0	... 19 0 0
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	... 14 10 0
Third yellow deals, 3 in. by 11 in. and 9 in.	13 10 0	... 15 0 0
Battens, 2½ in. and 3 in. by 7 in.	11 0 0	... 12 0 0
Petersburg first yellow deals, 3 in. by 11 in.	21 0 0	... 22 10 0
Do. 3 in. by 9 in.	18 0 0	... 19 10 0
Battens	13 10 0	... 15 0 0
Second yellow deals, 3 in. by 11 in.	16 9 0	... 17 0 0
Do. 3 in. by 9 in.	14 10 0	... 16 0 0
Battens	11 0 0	... 12 10 0
Third yellow deals, 3 in. by 11 in.	13 0 0	... 14 0 0
Do. 3 in. by 9 in.	12 10 0	... 14 0 0
Battens	10 0 0	... 11 0 0
White Sea and Petersburg— First white deals, 3 in. by 11 in.	14 10 0	... 15 10 0
,, ,, 3 in. by 9 in.	13 10 0	... 14 10 0
Battens	11 0 0	... 12 0 0
Second white deals, 3 in. by 11 in.	13 10 0	... 14 10 0
,, ,, 3 in. by 9 in.	12 10 0	... 13 10 0
,, ,, battens	10 0 0	... 11 0 0
Pitch-pine: deals	18 0 0	... 21 0 0
Under 2 in. thick extra	0 10 0	... 1 0 0
Yellow Pine—First, regular sizes	44 0 0	upwards.
Oddments	32 0 0	,,
Seconds, regular sizes	33 0 0	,,
Yellow Pine oddments	28 0 0	,,
Kauri Pine—Planks, per ft. cube	0 3 6	... 0 5 0
Danzig and Stettin Oak Logs— Large, per ft. cube	0 3 0	... 0 3 6
Small ,, ,,	0 2 6	... 0 2 9
Wainscot Oak Logs, per ft. cube	0 5 6	... 0 6 0
Dry Wainscot Oak, per ft. sup. as inch	0 0 8½	... 0 0 9½
¾ in. do. do	0 0 7	... —
Dry Mahogany—Honduras, Tabasco, per ft. super. as inch	0 0 9	... 0 1 0
Selected, Figury, per ft. super. as inch	0 1 6	... 0 2 6
Dry Walnut, American, per ft. super. as inch	0 0 10	... 0 1 0
Teak, per load	17 0 0	... 22 0 0
American Whitewood Planks, per ft. cube	0 4 0	... 0 5 0
Prepared Flooring, etc.—	Per square.	
1 in. by 7 in. yellow, planed and shot	0 13 6	... 0 17 6
1 in. by 7 in. yellow, planed and matched	0 14 0	... 0 18 0
1¼ in. by 7 in. yellow, planed and matched	0 16 0	... 1 0 0
1 in. by 7 in. white, planed and shot	0 12 0	... 0 14 6
1 in. by 7 in. white, planed and matched	0 12 6	... 0 15 0
1¼ in. by 7 in. white, planed and matched	0 15 0	... 0 16 6
¾ in. by 7 in. yellow, matched and beaded or V-jointed brds.	0 11 0	... 0 13 6
1 in. by 7 in. ,, ,,	0 14 0	... 0 18 0
¾ in. by 7 in. white ,, ,,	0 10 0	... 0 11 6
1 in. by 7 in. ,, ,,	0 12 9	... 0 15 0

6 in. at 6d. to 9d. per square less than 7 in.

JOISTS, GIRDERS, &c.

	In London, or delivered Railway Vans, per ton. £ s. d.		£ s. d.
Rolled Steel Joists, ordinary sections	7 0 0	...	7 10 0
Compound Girders, ordinary sections	9 0 0	...	10 0 0
Steel Compound Stanchions	12 0 0	...	13 0 0
Angles, Tees, and Channels, ordinary sections	9 0 0	...	10 0 0
Flitch Plates	9 0 0	...	10 0 0
Cast Iron Columns and Stanchions including ordinary patterns	7 10 0	...	8 10 0

METALS.

	Per ton, in London. £ s. d.		£ s. d.
IRON—			
Common Bars	8 0 0	...	8 10 0
Staffordshire Crown Bars, good merchant quality	8 10 0	...	9 0 0
Staffordshire "Marked Bars"	10 10 0	...	—
Mild Steel Bars	8 15 0	...	9 0 0
Hoop Iron, basis price	9 5 0	...	9 10 0
" Galvanised	17 0 0	...	—
("And upwards, according to size and gauge.)			
Sheet Iron Black—			
Ordinary sizes to 20 g.	9 10 0	...	—
" " 24 g.	10 10 0	...	—
" " 26 g.	12 0 0	...	—
Sheet Iron, Galvanised, flat, ordinary quality—			
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.	14 0 0	...	—
Ordinary sizes to 22 g. and 24 g.	14 10 0	...	—
" " 26 g.	15 0 0	...	—
Sheet Iron, Galvanised, flat, best quality—			
Ordinary sizes to 20 g.	17 0 0	...	—
" " 22 g. and 24 g.	17 10 0	...	—
" " 26 g.	19 0 0	...	—
Galvanised Corrugated Sheets—			
Ordinary sizes 6 ft. to 8 ft. 20 g.	14 0 0	...	—
" " 22 g. and 24 g.	14 10 0	...	—
" " 26 g.	15 15 0	...	—
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker	11 10 0	...	—
Best Soft Steel Sheets, 22 g. & 24 g.	12 10 0	...	—
" " " 26 g.	14 15 0	...	—
Cut Nails, 3 in. to 6 in.	9 10 0	...	9 15 0
(Under 3 in., usual trade extras.)			

LEAD, &c.

	Per ton, in London. £ s. d.		£ s. d.
LEAD—Sheet, English, 3lb. and up.	20 15 0	...	—
Pipe in coils	21 5 0	...	—
Soil pipe	23 15 0	...	—
Compo pipe	23 15 0	...	—
ZINC—Sheet—			
Vieille Montagne ton	33 10 0	...	—
Silesian	33 5 0	...	—
COPPER—			
Strong Sheet per lb.	0 1 1	...	—
Thin "	0 1 2	...	—
Copper nails "	0 1 0	...	—
BRASS—			
Strong Sheet "	0 1 0	...	—
Thin "	0 1 1	...	—
TIN—English Ingots "	0 1 9	...	—
SOLDER—Plumbers' "	0 0 8½	...	—
Tinmen's "	0 0 10½	...	—
Blowpipe "	0 0 11½	...	—

ENGLISH SHEET GLASS IN CRATES OF STOCK SIZES.

15 oz. thirds	2½d. per ft. delivered.
" fourths	1¾d. " "
21 oz. thirds	3¼d. " "
" fourths	2¼d. " "
26 oz. thirds	4¼d. " "
" fourths	3¼d. " "
32 oz. thirds	5d. " "
" fourths	4¼d. " "
Fluted Sheet, 15 oz.	3¼d. " "
" 21 oz.	4¼d. " "

ENGLISH ROLLED PLATE IN CRATES OF STOCK SIZES.

¼ Hartley's	2½d. per ft. delivered.
¼ "	2¾d. " "
½ "	3d. " "
Figured and Oxford Rolled "Oceanic" Glass, white ...	4d. " "
Do. " tinted ...	5¼d. " "

OILS, &c.

		£ s. d.
Raw Linseed Oil in pipes	per gallon	0 1 9
" " " in barrels	"	0 1 10
" " " in drums	"	0 2 0
Boiled " " in pipes	"	0 1 11
" " " in barrels	"	0 2 0
" " " in drums	"	0 2 2
Turpentine in barrels	"	0 3 10
" in drums	"	0 4 0
Genuine Ground English White Lead	per ton	23 10 0
Red Lead, Dry	"	22 10 0
Best Linseed Oil Putty	per cwt.	0 7 0
Stockholm Tar	per barrel	1 12 0

VARNISHES, &c.

	Per gallon. £ s. d.
Fine Pale Oak Varnish	0 8 0
Pale Copal Oak	0 10 6
Superfine Pale Elastic Oak	0 12 6
Fine Extra Hard Church Oak	0 10 0
Superfine Hard-drying Oak, for seats of Churches	0 14 0
Fine Elastic Carriage	0 12 6
Superfine Pale Elastic Carriage	0 16 0
Fine Pale Maple	0 16 0
Finest Pale Durable Copal	0 18 0
Extra Pale French Oil	1 1 0
Eggshell Flatting Varnish	0 18 0
White Copal Enamel	1 4 0
Extra Pale Paper	0 12 0
Re-span Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 8 6
Berlin Black	0 16 0
Knotting	0 10 0
French and Brush Polish	0 10 0

TO CORRESPONDENTS.

NOTE.—The responsibility of signed articles, letters, and papers read at meetings rests, of course, with the authors.

We cannot undertake to return rejected communications; and the Editor cannot be responsible for drawings, photographs, manuscripts, or other documents, or for models or samples, sent to or left at this office, unless he has specially asked for them.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

All communications must be authenticated by the name and address of the sender whether for publication or not. No notice can be taken of anonymous communications.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article, or to execute or lend a drawing for publication, is given subject to the approval of the article or drawing, when received, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance. The Editor cannot undertake to read and consider articles offered for acceptance unless they are type-written.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and not to the Editor.

TENDERS.

Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than* 10 *a.m. on Thursdays.* [N.B.—We cannot publish Tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of Tenders accepted unless the amount of the Tender is stated, nor any list in which the lowest Tender is under 100*l.*, unless in some exceptional cases and for special reasons.]

* Denotes *accepted.* † Denotes *provisionally accepted.*

ACCRINGTON.—For building a small villa, for Dr. Frankish, Accrington. Mr. W. E. Wood, Quantities by Mr. W. E. Wood:—

Mason: W. H. Bury & Son, Oswaldtwistle
Joiner: R. Huxbury, Oswaldtwistle
Slater: E. Welch, Accrington
Plasterer: G. Eastwood, Accrington
Plumber: R. T. Kenyon, Rishton
} As per schedule.

BRADFORD (Devonshire).—For alterations, general repairs, painting, etc., at Council school, for Education Committee. Mr. P. Morris, Architect, 1, Richmond-road, Exeter:—

W. A. Beckley	£399 9 1	Ridge, Prior, & Harding, Bideford*	£328 10 0
W. Perkin	368 8 3		

BRIXHAM (Furzeham Hill).—For alterations and additions and tar-paving the playgrounds of the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

Hazlewood Bros.	£853 5 0	F. A. A. Stacey	£740 0 0
T. Silley	850 0 0	Hayman & Wills, Brixham*	680 16 10
Hazlewood & Son	776 1 6		

CARMARTHEN.—For building a sanitary block at Carmarthenshire Infirmary. Messrs. J. Morgan & Sons, architects:—

W. Davies, St. Catherine-street, Carmarthen .. £352

CHADDERTON.—For the construction of sewers for the sewerage of Middleton Junction district, for the Urban District Council. Messrs. J. Diggle & Son, engineers, Hind-hill-street, Heywood, and Westminster:—

T. Turner, Heywood £3,220 12 7

CHEVINGTON (Northumberland).—For parish hall, etc. Mr. A. B. Plummer, F.R.I.B.A., 13, Grey-street, Newcastle-on-Tyne:—

First Contract, Exclusive of Boundaries, etc.

R. & G. Brown, Amble, Northumberland† £631 8 5

COMBE MARTIN.—For additions and alterations at the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter. Quantities by Mr. S. W. Haughton, 22, Courtenay-street, Plymouth:—

F. A. A. Stacey	£1,769 0 0	R. Goss & Son, Combe Martin*	£1,195 13 7
Burgess & Lovering	1,199 5 1	Woodman & Son‡	1,179 0 0

‡Withdrawn.

COWPEN.—For flagging the bottom and slopes of a settling pond at Choppington Colliery, for the Urban District Council. Mr. R. Grieves, Surveyor, Seaforth-street, Blyth:—

A. Best	£337 13 0	J. Robson, Newcastle-on-Tyne*	£229 9 3
Burn Bros.	267 19 3		
W. Robertson	267 0 6		

DARTMOUTH.—For demolishing and rebuilding the "Globe Inn," South-embankment, for Messrs. J. Bartlett & Co. Mr. R. Montague Luke, C.E., 15, Princess-square, Plymouth:—

T. Vanstone	£580 0 0	G. B. Andrews	£397 0 0
R. E. Narracott	550 0 0	M. Bridgeman	387 18 11
H. Drew	480 0 0	F. W. Gullett, Dartmouth*	349 0 0
Back & Watts	434 0 0		
Yoe & Sons	414 0 0		

DUNSFORD.—For alterations and additions to the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

F. J. Zealley	£365 0	A. J. Parker, Newton Abbot*	£286 18
		Kingwell & Castle	284 0

DEVONPORT.—For levelling, paving, and completing the following lanes, viz.:—Contract 95—lane between Maristow and Cotehele avenues (sect. 2); Contract 96—lane between Maristow and parts of St. Aubyn and St. Michael avenues; Contract 98—lane rear of Monument-street; Contract 101—lane between Herbert-place and Haddington-road; Contract 105—lane between Ocean-street and Renown-street (sect. 1), for the Devonport County Council. Mr. J. F. Burns, Borough Surveyor, Municipal Offices, Ker-street, Devonport:—

Contract 95.

Shawdon & Sons	£457 5 10	T. Doney	£421 11 2
Jefford & Son	431 18 6	Pethick Bros., Plymouth*	413 17 6

Contract 96.

Shawdon & Sons	£311 1 1	Pethick Bros., Plymouth*	£291 5 6
Jefford & Son	307 6 2		
T. Doney	300 3 11		

Contract 98.

Shawdon & Sons	£143 13 0	T. Doney	£136 1 11
Jefford & Son	139 6 5	Pethick Bros., Plymouth*	131 14 6

Contract 101.

Shawdon & Sons	£346 0 1	Pethick Bros., Plymouth*	£305 8 0
T. Doney	328 8 0		
Jefford & Son	325 10 0		

Contract 105.

Shawdon & Sons	£445 11 3	T. Doney	£409 11 8
Jefford & Son	424 19 11	Pethick Bros., Plymouth*	406 4 0

EDMONTON.—For the following works at the Workhouse, situated at Upper Edmonton, near Silver-street Station (G.E. Rlwy.):—1. General exterior repairs, cleaning, painting, etc. 2. (*a*) Repairs to roof of laundry building, and alternately; (*b*) Construction of new roof altogether for the Strand Guardians. Mr. A. A. Kekwick, architect, 18 and 19, The Outer Temple, Strand:—

General Exterior Repairs, Painting, etc., at Workhouse.

A. Monk	£945 0	F. W. Harris & Co., Ltd.	£439 0
T. G. Sharpington	908 0	H. Wilmott	429 0
Love & Co.	875 0	J. Johnson	410 0
W. D. Ridgway	650 0	W. Moore & Son	399 0
J. Stewart	556 0	Limmer & Gallow-way	301 15
Barrett & Power	538 0	P. McCarthy, 441, Fulham-road*	297 0
J. J. Richards	524 0		
A. Porter	493 0		

Repairs to Roof of Laundry.

F. W. Harris & Co., Ltd.	£340 0	T. G. Sharpington	£242 0
Barrett & Power	313 0	Love & Co., Exeter-street, Strand*	205 0
A. Monk	265 0	J. Stewart	198 15

FINCHLEY.—For erecting a cold water softening plant, for the Urban District Council. Mr. E. Calvert, electrical engineer, Squire's-lane, Finchley, N.:—

Kennicott Water Softener Co., 29, Great St. Helens, E.C.* £300 10

GRIMSBY.—For the erection of public conveniences. Mr. H. Gilbert Whyatt, A.M.Inst.C.E., Borough Engineer and Surveyor, Town Hall, Grimsby:—

—	River Head.	Newmarket-street Foot bridge.	Rear of Palace Theatre.
	£ s. d.	£ s. d.	£ s. d.
Holmes & Richardson	235 10 0	95 10 0	215 0 0
R. G. Kitchen	233 15 0	89 0 0	216 0 0
W. Gilbert, Grimsby*	227 19 6	88 12 6	206 8 6

HARTLAND.—For repairs, painting, etc., and for new drainage works and alterations to offices at Council school, for Devon County Education Authority. Mr. P. Morris, Architect, 1, Richmond-road, Exeter:—

S. Cann	£341 0 3	Ridge, Prior, & Harding, Bideford*	£307 16 6
I. Cock	328 5 6		
Lee & Ellis	314 19 0		

HENLEY-ON-THAMES.—For converting school building into an infirmary, for the Guardians. Messrs. C. Smith & Son, architects, 164, Friar-street, Reading:—

C. W. Cox	£1,800 0	Walden & Cox	£1,400 0
W. Hawkins	1,700 0	H. Harris	1,316 0
McC. E. Fitt	1,665 0	Batten Bros.	1,285 0
Godwin	1,652 0	M. Payne & Co.	1,280 0
Martin, Wells, & Co.	1,600 0	T. Stimson	1,010 5

HITTISLEIGH.—For general repairs and alterations at the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

Dart & Francis	£195 0 0	Counter & Glandfield, South Zeal*	£101 9 0
H. Berry	185 0 0	Partridge & Endacott	97 18 6
E. Gillard & Son	120 18 6		
W. Backwell	118 3 0		

ISLEWORTH.—For reconstruction of Oak Bridge, for the Heston and Isleworth Urban District Council. Mr. J. G. Carey, Acting Surveyor:—

C. Gray	£1,100 0	W. W. Muirhead & Co.	£520 0
J. Mowlem & Co.	780 0	Langley & Johnson, Slough, Bucks*	418 0
Rawkins & Jackson	674 0		
T. Watson, jun.	620 0		
Hughes & Stirling	606 10		

ISLEWORTH.—For reconstruction of Queen's Bridge, for the Heston and Isleworth Urban District Council. Mr. J. G. Carey, Acting Surveyor:—

C. Gray	£1,300	Rawkins & Jackson	£933
J. Mowlem & Co.	1,176	W. Muirhead & Co.	850
T. Watson, jun.	966	Langley & Johnson, Slough, Bucks*	671
Hughes & Stirling	935		

LIDGATE.—For rebuilding a bridge, for Moulton Rural District Council. Messrs. Holland & Son, Newmarket. Quantities by Messrs. Holland & Son:—

H. W. Kelly	£280 0	J. C. & E. B. Whitmore	£227 0
Mason & Son	249 0	E. K. Simpson	198 19
S. Rolfe, Cheveley, Newmarket*	235 0		

in the Fayoum, showing that its use was not unknown to them. The Egyptian glass tesseræ, made by fusing together many rods of coloured glass arranged in a pattern and then cutting the mass across at right angles, are well known. Here we have what is to all intents and purposes mosaic on a very small scale, and the magnifying and modification of the manufacture is a small matter to an intelligent and mechanical people.

It is generally assumed, with great probability, that the art is Oriental in its origin and travelled westwards through Greece to Rome. The Greeks called it *psephosis*, from which the Arabs made the word *foseifisa*, though both Hesiod and Sophocles use *lithostratos*. In Latin the general names used are *lithostratum*, *opus musivum*, *mosaicum tesselatum* (from *tessela*, a die). *Musivum*, a late Greek work, is generally used for vitreous mosaic, as opposed to *lithostratum* for marble pavements. The only Greek example which has come down to us is the pebble mosaic in the temple of Zeus at Olympia (470-457 B.C.), and this does not give us a very high idea of the talent of the Greek craftsmen, being merely an imitation of a carpet not very well executed, but it is probably not very early. Pliny says that "lithostrata" were introduced in Rome in the time of Sylla (80 B.C.); at all events, there is still in existence a pavement formed of small pieces, which he ordered to be laid down in the Temple of Fortune at Prænestе. The durability of the ancient pavements is mainly due to the extraordinary care which was bestowed on the preparation of the bed. Vitruvius gives curious details on the expedients adopted to ensure their lasting. "In order that the mortar at the joints may not suffer from the frost" (this is a slab pavement) "at the approach of winter every year it should be saturated with the dregs of oil, which will prevent the frost affecting it." "If extraordinary care be required, the pavement is covered with tiles, 2 ft. square, properly jointed, having small channels of the size of 1 in. cut on each edge. These are filled with lime tempered with oil, the edges being rubbed and pressed together. Thus the lime in the channels growing hard suffers neither water nor anything else to penetrate. After this preparation the upper layer (two parts of fresh rubbish, one of potsherds, and two of lime) is spread, 1 ft. thick, and beaten with sticks. Over this either large tesseræ, 2 in. thick, or angle tiles are laid at the inclination above directed (2 in. in 10 ft.), the pattern having been drawn and liquid cement poured on, an even surface being obtained by friction with marble, and work so executed will not be easily injured." The cement for finer mosaics was slaked lime one part, powdered marble three parts, mixed with water and white of egg. The Greeks made a kind of composition pavement for winter rooms, which was something of the same sort as the Roman *opus signinum* without the tesseræ of marble. The surface was excavated 2 ft. deep, the bottom was well rammed, and a layer of rubbish or potsherds spread over it with a slope towards the holes of the drain. "A composition of pounded coal (charcoal, of course), lime, sand, and ashes is mixed up and spread thereover, ½ ft. in thickness, perfectly smooth and level. The surface being then rubbed with stone it has the appearance of a black pavement." It was absorbent and warm to the feet of the slaves.

At first mosaic appears to have been used only for the pavements of temples, colonnades, and houses to which special distinction was desired to attach. From simple geometrical designs they progressed to those of a more complicated kind, lessening the size of the stones; then the imitation of natural objects commenced. The carpet already mentioned at the Temple of Zeus at Olympia is a *motif* of frequent occurrence. On the floors of triclinia they imitated the fragments of food thrown on the floor, and great reputation was gained by the "asarotus œcus," in which this imitation was carried to the verge of deception; so early were the true principles of art violated. Sosus, of Pergamon, was celebrated for these mosaics, an example of which is to be seen in the Lateran Museum; in the Capitoline Museum is a copy of one of his best-known works, found in the villa of Hadrian, a basin on the edge of which are two pigeons. The largest antique mosaic was found at Palestrina (the ancient Prænestе), a curious geographical, zoological, and ethnographical picture of Egypt. A writer in *Archæologia* in 1790, says that it was made by Greeks, "as appears from the inscriptions." Another very large antique mosaic is that found in 1869 in the Piazza Vittoria, Palermo, and now in the Museo Nazionale in that city. Wherever the Romans went mosaic pavements are found, and it is unnecessary to multiply examples since the various museums are full of them. Reference may, however, be made to those discovered in North Africa, to the large one representing circus games discovered at Seville in 1799, and the enormous mosaics from the baths of Caracalla. The designs for the smaller floors are generally geometric, and the colours employed are few; if figures or animals are introduced, as became the case in the more important rooms in the IIIrd century, the arrangement is geometric, though the details may be free and even pictorial, as is seen in those found at Carthage and Sour. The most elaborate examples that can be quoted are the celebrated Battle of Arbela in the museum at Naples and the floor of Hiero II.'s pleasure gallery, which had subjects from the Trojan War. The artists who produced these elaborate works occasionally signed them, and Muntz gives the following list of names thus obtained:—Sosus (already mentioned), Dioscorides of Samos (who is said to have executed a comic subject for Cicero's Villa), Heraclitus, Proclus, Julius Soter, Fuscus, Prostatius, Ariston, Neithodorus. These ambitious works are rarely so successful as the simpler pavements in black and white, or with even five or six colours; the talent of the mosaicist seems to be overweighted and the palette overcharged. The columns and fountains decorated with mosaic now in the museum at Naples should not be overlooked, as showing another application of the material.

From the IVth century A.D. mosaic became the special decoration of religious buildings. The church of S. Costanza, on the Via Nomentana, close to S. Agnese, contains the earliest examples at Rome. The Liber Pontificalis says: "Constantine built the basilica of St. Agnes, saint and martyr, at the request of Constantia his daughter, and a baptistery in the same place, where was baptised, by the Bishop Sylvester, Constantia his sister with the daughter of Augustus." The mosaics remaining are those on the two apses and the vault of the aisle which surrounds the church. The vault is divided into eleven compartments with a grey ground, in several of which the same design is repeated. They are decorated with simple ornament, medallions and single figures, with branches of flowers, birds, and vases strewn over the surface, and two compartments show vintage scenes, the whole surface being covered with vine branches, among which naked children gather the grapes. The wine-press and the ox-wagons, which transport the grapes thither, are below on each side. The vault over the place where the sarcophagus of Constantia once stood (now in the Vatican Museum) has a gold ground. In the apses Jesus Christ is represented twice; in one case He stands blessing with His open right hand and holding in the left an unrolled scroll, on which is "Dominus pacem dat" and the labarum monogram; two apostles, Thomas and Philip, stand near; four lambs, which symbolise the faithful, are arranged in couples in front, and three streams of water; while two shapeless buildings at each end, sheltered by a palm-tree, suggest the two cities of Bethlehem and Jerusalem which appear so often. The apostles are robed in white. The other composition in which, seated on the globe, He gives the keys to S. Peter, with palm-trees, symbols of Judæa, making up the composition, has been copied in colour in the catacomb called Platonia. There may perhaps be earlier examples in the catacombs (which Gerspach says were executed by hands "guided rather by faith than talent"), such as the very curious one in the cemetery of S. Hermes representing the resurrection of Lazarus and the prophet Daniel.

The catacombs were used till Alaric's taking of Rome (410), but burials gradually ceased after the edict of Milan. The word catacomb is derived from the phrase "kata tumbas" (sometimes written "cumbas"), near the tombs ("of SS. Peter and Paul" understood) on the Via Appia, the catacomb of S. Sebastian. They generally have several stories, and as many as five even are known. A very complicated symbolism was gradually evolved, much of which was pagan in origin. The common symbols are the Anchor (sign of hope), the Lamb or Sheep, the Dove (the Christian soul freed from earthly bonds) with an olive branch (peace by the Bible). In later mosaics it sometimes represents the souls of the apostles. The Phœnix (the soul) is a later symbol, rarely found in the catacomb but sometimes carved on pagan tombs. The fish (Christ) is a symbol of the time of the apostles. The Cross is never painted in early times, but suggested by a bird with spread wings or a man praying with outstretched arms. The Greek "tau" was used instead of it also. The Good Shepherd, the Vine, the Wise and Foolish Virgins, and Noah's Ark are common; Jonah, Daniel, the Three Children in the Furnace, Adam and Eve, the Sacrifice of Abel and Cain, Elijah in the Fiery Chariot, and the Raising of Lazarus, all symbolising Resurrection. Baptism is symbolised by Moses Striking the Rock and the presence of Deity by a hand issuing from a cloud. The figure of Christ does not appear till the IVth century. The Virgin appears often in the IIIrd, and in the catacombs of S. Priscilla is a picture of her seated, which De Rossi thinks nearly of apostolic age. The figures called "Orantes" are regarded as symbols of prayer; sometimes they may mean the Church on earth on the soul of the dead praying for salvation. The holy mysteries are only occasionally represented. Flowers and trees are generally symbols of Paradise. In the catacombs of S. Domitilla the story of Psyche appears, and Orpheus is of frequent occurrence. After Constantine's Edict the Lamb becomes an important symbol. The stag at the fountain symbolises baptism and the 42nd Psalm, the peacock and eagle triumph, and the palm and crown martyrdom. In the Primitive Church the attitude of prayer was either prostrate with hands raised to Heaven or with the arms stretched out crosswise or standing; never kneeling. The nimbus was very rarely used in Christian art before the IVth century; at S. Costanza Christ has it (a large disc of gradated blue), but not the apostles. In S. Agatha, Ravenna (400), Christ has a cruciferous nimbus and the angels simple circles. At S. Maria Maggiore, Rome, Herod has a nimbus, and at S. Vitale, Ravenna, one is given to both Justinian and Theodora. In a mosaic of the Triumph of Neptune and Amphitrite, found near Constantine, in Algeria, both Deities have it. The Throne in Heaven appears, the twenty-four Elders and other symbols form the Apocalypse, the four beasts the symbols of the Evangelists. The book with the seven seals, the candlesticks, the four angels, and the Lamb was so commonly used as the symbol of Christ that the Council of Constantinople (693) decided that it was no longer to be used, since there was danger of the figure of Christ being left out altogether. The rules for the distribution of subjects over the walls and vault had the force of laws for 800 years, from the beginning of the Vth to the end of the XIIIth century. The great arch in front of the sanctuary was reserved for symbols of the triumph of religion, and was therefore called the "triumphal arch." The apse and tribune very often repeated these symbols, but completed the subject by the representation of holy personages, thus forming a picture of which Christ was always the centre. The nave walls were reserved for narrative compositions, scenes from the Old and New Testaments, parables, etc. Until the end of the VIIth century baptisteries were always outside the church. To encourage the building of churches Constantine freed from taxation architects, painters, sculptors, and mosaicists. M. Gerspach says his successors imitated him, and so a school was formed on the shores of the Bosphorus.

The church of S. George, Thessalonica, was built by Constantine during his first stay in that city, according to Texier and Pullan, and the bricks bear Christian stamps. The cupola is covered with mosaics—rich palaces in the style of the Pompeian paintings, with curtains looped to the sides and hanging lamps, peacocks, and richly-dressed figures in adoration with raised hands standing on

a patterned pavement in perspective. "In the centre of each of these compositions is a little octagonal or circular house, surrounded by columns and covered by a cupola; it is screened off by low barriers, and veils conceal the interior. A lamp suspended from the ceiling indicates its character; it is the new tabernacle, or *sanctum sanctorum*, of the Christians." There is a great variety in the design of these little temple buildings; in one instance there are no veils but lamps hung beneath each arch; in another in which the curtain appears there are four columns and a dome with three steps, evidently a high altar; in another there is a ciborium with a lamp suspended, but neither veil nor altar, in the centre of a semi-circular apse. There are ten principal colours used, but the tints are infinite, and the tesseræ are all vitreous. "The outline of each figure is marked by a dark shade, and the middle is filled with cubes, which are arranged so as to follow the outline." In S. Sophia, Thessalonica, the bricks in the women's gallery are stamped in the same way as those in S. George. The dome has a mosaic of the Ascension on a gold ground. The Virgin and the Twelve Apostles surround the dome, separated by trees. The Christ is in the centre, but an Arabic inscription leaves only his feet visible. The figures are more than 12 ft. high. In the apse is a Virgin seated with the infant Jesus; on the walls is a diaper on a square base, with a silver cross and vine leaves. At Eski-Djouma, a church which resembles the very early church of S. Demetrius in design, the soffits of the arches have good mosaic decorations on a gold ground in the parts not plastered.

The vault of the chapel of S. Rufinus in the Lateran Baptistery is of the end of the IVth or beginning of the Vth century; on a blue ground large foliated volutes unroll, green touched with gold. In the church of S. Pudentiana, Rome, is a fine mosaic, which has been ascribed to the VIIIth century, but an inscription formed part of it before Cardinal Gætani reconstructed the church in 1598, which ran, "Maximus fecit cum suis." De Rossi found fragments of inscriptions in the church, which showed that under the pontificate of Siricius (390-5) a certain Maximus did great works, taking eight years to execute them, at his own cost. This seems to make it certain that the mosaic is really of the IVth century. Barbet de Jouy calls it the most remarkable mosaic in Rome. The church itself may be considered as one of the most ancient in that city, having been founded by Pius I. of Aquileia on the site of the house of Pudens, though repaired by Adrian I. (772-795), having become ruinous The composition is good, the drawing firm and expressive. S. Praxedes is remarkably beautiful; the head of S. Peter is in a grand style, and to find an equally fine type one must go back to the heads of the apostles on those previous fragments of gilded glass worked with the point found in the catacombs near the tombs of the first Christians. In the centre Christ is enthroned, SS. Pudentiana and Praxedes offer martyrs' crowns of golden leaves, below are ten figures of the apostles. Above the figure of Christ is a barren hill with a jewelled cross upon it, and a semi-circular portico forms a background to the figures, above which buildings appear In the sky the evangelists' symbols appear for the first time. Christ holds in His hand an open book upon which is written, "Dominus conservator ecclesiæ Pudentianæ." Some argue that the women's figures symbolise the Jewish and Gentile Churches.

From literary notices we know that there were French mosaics of the Vth century, but no examples have come down to us. A notice in the life of S. Laurence, Bishop of Siponto, a relation of the Emperor Zeno (474-91) shows how Italy looked eastward for its inspiration at that time. "When it was resolved to ornament with elegant and beautiful works the churches of S. Stephen and S. Agatha, situated near the Adriatic shore, and to build another close to the city in honour of the blessed S. John Baptist, he wrote to the Emperor hoping that their relationship would dispose him to receive his message favourably. He asked him to send him masters and workmen clever in all arts. The Emperor received the envoy of the Holy Bishop with joy, and charged himself with sending the most accomplished artists; further, with devotion and liberality, he charged them to carry to Siponto gold to contribute to the execution of the work and help in finishing the church. Having received this precious gift the holy man began and finished admirable and precious works in the basilica of the aforesaid martyrs; then he began another of a brilliant and wonderful beauty by the different colours and little pieces of glass covered with gold with warm reflections of which it was composed. He executed this work in honour of S. John Baptist in his Episcopal Church."

The mosaics in the baptistery of the cathedral at Ravenna date from about 435 A.D., and those of the mausoleum of Galla Placidia are but a little later. The baptistery was rebuilt by Neon in 430, though constructed or adapted by Ursus 100 years and more earlier. The centre of the dome shows the baptism of Christ, with the river God of Jordan on a gold ground. Round this central subject are figures of the Apostles on a blue ground, carrying crowns. Beneath these figures runs a broad frieze, on which four altars with open books of the Gospels upon them and thrones with crosses are represented between light columns. On the lower part of the wall are mosaics of gold wreaths on a blue ground, with figures of Saints in cartouche, and elaborate ornamental opus sectile in red and green porphyry. The tomb of Galla Placidia (SS. Nazzaro e Celso, 440 A.D.) contains mosaics of great delicacy. Here on a dark blue ground in the centre of the cupola is a golden cross with an aureole, and on the four pendentives the symbols of the Evangelists. There are doves drinking from a vase, stags drinking (both copied from the antique), and figures of eight apostles or prophets on the vaults. Above the door is the Good Shepherd among his sheep, young and beardless, seated and leaning on a cross; he has an immense simple nimbus, the sheep are six in number, and there are rocks and bushes round a gradated sky. Opposite is S. Laurence going to his martyrdom (described by some as Christ committing to the flames some heretical book). The drawing is good, the figures are dressed as Romans and fully draped, and the general colouring is harmonious. The ornaments and scrolls are gold or green, the draperies white, the ground a yellow-green gradually losing itself in the background. The chapel of S. Pier Crisologo, in the Archbishop's Palace, is a structure of the Vth century, and though much restored, altered, and added to, still contains remains of mosaics of that date. In the centre of the vault is the monogram of Christ supported by four angels, between them are the symbols of the Evangelists, and a beardless Christ is in the centre of the arch. The ground is golden. Above the altar are a Madonna in prayer and two Saints, which were originally in the cathedral. The arch above this has a diaper of crosses, with birds in the squares between.

The baptistery at the side of S. Restituta, at Naples, contains some remains of mosaics of the second half of the Vth century in a very bad state of preservation, and much mended with paint. It is square, with a low hemispherical cupola, which becomes octagonal in the lower part; the angles bear on cross arches, which form niches. The vault and the octagonal drum were decorated with mosaics by Bishop Sotera. The centre has a field of blue studded with stars of different sizes, the smaller of which are golden and the larger of silver, on which is the sacred monogram and A. & W. gilded; peacocks, doves, and other birds in the border feed on flowers and fruits in vases. At the summit the hand of God appears holding a crown of golden leaves enriched with sapphires and tied with ribands. A second zone surrounds the first, peopled with peacocks, doves, and other birds facing each other before a vase in the manner which we now know as Byzantine. The details have lost clearness, but the attitudes are natural and the vases elegant. Then come eight compartments with bands of ornament, arabesques, birds, and vases of flowers and fruits, which get larger as they near the base of the dome. Of the compositions between only five remain, facing each other, and two of these have been repainted, the Supper at Emmaus and the Evangelical Salutation. The one in a tolerable state shows Christ standing on a blue globe giving the law to SS. Peter and Paul, with two palm-trees in the corners of the composition, called "The Gift of God." The saints have suffered a good deal. The third compartment contains two figures: one seated with a scroll receives the homage of a veiled woman, who kneels before him. The fifth compartment is partly mosaic and partly paint, and may perhaps represent the miraculous draught of fishes. The other two compartments are blank, though one shows traces of the figure of a kneeling woman. In the angles are symbols of the Evangelists on blue backgrounds, with stars and with red clouds, but S. Luke's bull has disappeared; they have neither wings nor nimbi. Above the niches are catacomb symbols and medallions, stags, lambs, and shepherds with palms. On the drum there are an enormous head of Christ, painted; below, two small, beardless Saints holding crowns, and robed in antique fashion; opposite, a bust of the Madonna, also painted; by her two Saints, one of whom holds a palm (XVIIth century work); in the centre of the wall opposite the window a painted grille, on each side of which a young figure advances holding a crown of gilded oak with a jewel in the centre. One is young and one is old; they are in Roman costume, and of good style. The general colour impression is grey-blue and green. The gold is of a greenish tint also. In S. Prisco, near Capua, are mosaics of the Vth century. On the vault are scrolls like those in the chapel of S. Rufinus in the Lateran baptistery. On the arch are three rows of rosettes with scrolls between, and in a lunette a bust of Christ in a circular frame. The ground of the vault is blue.

The Lateran baptistery, which was probably originally a bath in the house of Plautius Lateranus, had two chapels added to it by S. Hilary (in 461-7)—on the right that of S. John Baptist, in which the mosaics have been preserved; on the left that of S. John the Evangelist, in which they have been destroyed. The vault of the oratory of S. John Baptist has a gold ground; in the centre is a lamb surrounded by a circle of flowers enframed by a border of ornaments forming a square; this border is prolonged cross-wise. The angles of the vault are ornamented with scrolls, and four garlands of flowers, cut in their centres by the projections of the borders, bind the four angles of the central frame together. The eight sections of the field are each decorated with a couple of birds, who face a vase filled with fruit; the species are well-drawn ducks, paroquets, pigeons, and partridges. The lamb has a nimbus. The vases of fruit symbolise the earth, like the Pagan cornucopia. The birds express the elements —the duck, water; the partridge, earth; the pigeon, air; the paroquet, fire.

The triumphal arch of S. Maria Maggiore, Rome (the Liberian basilica, founded by Liberius I., 352-66, restored and decorated by Sixtus III., 432-40), bears the subjects of the Annunciation, the Presentation, the Adoration of the Kings, the Massacre of the Innocents, and Jesus among the Doctors. In the middle of the arch is a throne in a medallion, surmounted by the Cross, and with the Apostles SS. Peter and Paul at the sides of it; the towns of Bethlehem and Jerusalem finish the composition below. There are now thirty-six pictures above the windows in the nave; six were destroyed to open the arches to the Borghese and Sixtine chapels, three on each side, and seven of the thirty-six have been replaced by XVIth century paintings. The subjects are from the Old Testament, and the personages are dressed and armed like Romans. S. Paolo fuori was destroyed by fire on July 15, 1823. The triumphal arch has been restored, as nearly as may be reproducing that which Leo I. (440-61) put up. It shows the Apocalyptic worship: a colossal head of Christ surrounded by a rainbow, with the four Evangelists' symbols emerging from clouds above it, and with two angels at his side leaning on their sceptres, while the twenty-four Elders throw their crowns at his feet in groups of twelve. Lower down SS. Peter and Paul stand.

At Milan, in the chapel of S. Aquilinus, in S. Lorenzo, are two niches filled with mosaic, one of which, showing the Angel appearing to the Shepherds, in which the angel has no wings, but a long cross-headed pastoral staff, has been restored. The other shows Christ enthroned, surrounded by the Apostles, also seated. The ground is golden, and the Apostles have no nimbi. It much resembles

a primitive painting in the catacomb of S. Hermes. P. Garucci says that about 494 Bishop Lorenzo ornamented the churches of Milan with marbles and mosaics, and this is probably of that period.

At S. Sabina, on the Aventine, is a mosaic of the time of Celestine I. (422) on the western wall—an inscription in gold letters on a blue ground, and two figures of women on a golden ground draped like antique bas-reliefs, and representing the churches of the Circumcision and of the Gentiles. Probably the Apostles S. Peter and S. Paul were represented above them, without any other symbol.

The mosaics at Ravenna, for which Theodoric was responsible, were made by Roman workmen sent by the Prefect of Rome in answer to his request for stone and marble workmen. S. Apollinare Nuovo was built in the Vth century. Its twenty-four columns are of marble of Proconesos, brought specially from Constantinople. It was then called S. Martin "in cielo d'oro," because of the gold backgrounds to the mosaics in the apse, which were destroyed in the XVIth century, when it was reconstructed, and was the Arian Cathedral. The portions of Theodoric's work which remain are the large figures of Apostles and Saints between the windows and the twenty-six subjects from New Testament history above them. Of the same period is the baptistery of the Arians, afterwards known as the oratory of S. Maria in Cosmedin. The dome is covered with mosaics evidently suggested by those of the orthodox baptistery, but showing decadence in their style. The heads of the figures are larger, and between each couple is a palm-tree bearing dates. A throne with a jewelled cross upon it appears as the point towards which the Apostles advance. The figures in the central composition show the greatest falling off.

The church of S. Vitale is on the site of his martyrdom, and replaces a little chapel consecrated by Neon. It was built by Ecclesius (524-34), and consecrated in 547 by Maximian. Mosaics at one time entirely covered it above, and the lower walls were plated with marble. The mosaics still remaining are in the apse. On the soffit of the arch are busts of the Apostles, of SS. Gervasius and Protasius, sons of S. Vitalis, and of Christ. In the semi-dome Christ is shown enthroned on the globe, with angels on each side, and at one side S. Vitalis and at the other Ecclesius holding the church. Above the arch two flying angels hold a disc, and Jerusalem and Bethlehem fill the spandrils. Three windows are above this, the wall and spandrils enframing which have scrolls of vine issuing from baskets and vases with birds about them—motifs which are repeated on the vault. The lower part of the apse walls has on one side a mosaic of Justinian with his bodyguard and officers of the Court, and Maximian with attendant ecclesiastics, and on the other Theodora, with her ladies-in-waiting and chamberlain, apparently going from the Palace to the church. Both Emperor and Empress have large nimbi. The space between the apse and the great arch is pierced by two triple arcades beneath a semicircular arch; the whole is covered with mosaic. The four Evangelists are shown seated, beneath whom are standing figures of prophets. On the right beneath the lower arch the tympanum is filled with the subjects the Offering of Melchisedech, the Sacrifice of Cain, Moses as a Shepherd, and the Burning Bush; on the left the Three Angels Entertained by Abraham, Sarah at the Tent-door, and the Sacrifice of Isaac face them.

The rows of Saints in S. Apollinare Nuovo—virgins on one side approaching the Madonna and child, enthroned and attended by four angels, and men on the other approaching the throne of Christ, similarly attended, all bearing crowns, and separated by palm-trees—are the work of Agnellus (556-8) at the time when it was converted into a Catholic church.

The most important Eastern mosaics of this century were those of S. Sophia, Constantinople. The basilica was burnt during a tumult in 533. Justinian's architects—Anthemius of Tralles and Isidore of Miletus—reconstructed it with the help of 10,000 workmen, and in 559 he was able to open the church, crying as the festival procession entered: "O, Solomon, I have surpassed thee!" The interior was entirely covered with slabs of marble and mosaics on a ground of gold. These mosaics are the most delicate of the early Christian time; the tesseræ are all of vitreous pastes, and very small in the flesh, sometimes, indeed, only "half-a-line" thick, according to Kinkel. The bands of ornament further from the eye have stronger drawing, but the vault of the women's gallery is the place where the most delicate and elegant patterns have been put, being near the eye. The lunette over the door of entry, a Christ in majesty, with medallions of the Virgin and S. Michael on either side and a Byzantine Emperor in full State costume on knee and elbow in prayer at the feet of Christ, is considered to be the finest extant work of Byzantine art. Restorations were carried out in the IXth and in the XIVth centuries. Paulus Silentiarius in his poem on the church says: "Who once sets foot in this temple can desire nothing further." At evening the radiance of the light reflected from the metal work around the altar and the splendour of marble and mosaic was so great that "then it was as if under the arch of Heaven the multitude of stars sparkled. Also the shining church served as a landmark to the steersman afar on the sea; like a lighthouse it lighted his ship to the narrow entrance of the Bosphorus." Procopius also speaks most enthusiastically of its beauties: "When anyone enters there to pray, he feels immediately that this is not the work of art of men, but of the supreme Deity; and, raising his mind to God, it appears to him as large as Heaven, thinking it certainly not far off, and delighting himself in that blessed place to which his devout soul aspires. Nor is that the impression which the magnificent spectacle makes only on him who sees it for the first time, but it is renewed every time he returns, however often, as if he had never seen it before. For no one has ever had enough of it, and he who remains in the temple delights himself with that most grateful sight; and he who goes out still speaks of it, always more in wonder." Von Salzenberg says that the few remains of heads have considerable character, and that the draperies of the figures are well cast. The mosaics commence at the springing of the arches and vaults. On the western arch is a Virgin and Child and SS. Peter and Paul, much damaged. Of S. Peter only the head is left. S. Paul's head has gone, but his body remains. Between the nave windows on the south side are the figures of Authimus, Bishop of Nicomedi; a Basileos of Cæsarea, in Cappadocia; S. Gregory Theologos, patriarch of Constantinople; S. Dionysios the Areopagite, S. Nicholas of Myra, Gregory the Armenian, Bishop of Greater Armenia, and Isaiah. Above are the feet of angels. On the north side, higher up, are Jeremiah and Jonah and Habbakuk, of whom only part remains. Feet with sandals appear above them. On the eastern arch (covered up) is a medallion of the book, S. John Baptist on one side and the Virgin and child on the other. Below was a portrait of John Paleologos much damaged. On the arch of the Bema is an archangel on the south side, and in the small dome of the chamber from the western buttress four angels with uplifted hands; also in a cupola of the women's gallery small remains of the Descent of the Holy Ghost, cherubs on the pendentives of the great central vault, and a Virgin with a standing child, Jesus, robed in the apse vault. It is, however, probable that all these mosaics are posterior to the iconoclastic period of the VIIIth century.*

F. H. J.

CHURCH-HALL, SKETTY.—A church-hall was recently opened at Sketty, near Swansea. Mr. Glendinning Moxham, architect, prepared the plans for the work, the cost of which will be about 1,100*l.*

PARISH CHURCH, BROMHAM.—A fire, on the morning of September 11, destroyed part of the nave and roof, and burned out the tower, of St. Owen's Church, Bromham, near Bedford. The church contains some handsome monuments (which escaped destruction) to the Trevor and Dyve families, of whom was the royalist Sir Lewis Dyve. The church stands in the middle of the park: it was built *temp.* Edward IV., and was restored in 1844.

* To be continued.

PREMISES, MADDOX-STREET, W.

THESE premises, Nos. 41 and 43, Maddox-street, have been built for Mr. Edward Arnold, the publisher, and comprise storage, strong-room, and packing department in the basement, with extensive vaults under the roadway; manager's room, strong-rooms, sample-room, clerks' offices, and trade department on the ground floor; private rooms, etc., on the first floor. The second and third floors are for offices, with separate staircase, and further offices and rooms for caretaker are on the fourth floor. The building is equipped with hydraulic and other lifts, intercommunication telephones, and electric light. The front is of Portland stone to the first-floor level, and then Portland stone and Messrs. T. Lawrence's red bricks. The external woodwork to basement and ground floors, including lobbies, is of teak.

The general contractors were Messrs. E. A. Roome & Co., and the clerk of works Mr. W. Tidey. The constructional steelwork was supplied by Messrs. Homan & Rodgers.

Mr. W. Samuel Weatherley is the architect.

The Student's Column.

ROOFS: STRUCTURALLY CONSIDERED.—X.

17.—*Timber Roof Trusses.*

TIMBER is so convenient, so easily worked, and so cheap that it is never likely to be entirely superseded by other materials for roof principals and trusses of small span. Being protected from the weather, it is reasonably durable, and the chief objection against timber roof framework is the certainty of destruction in case of a serious fire.

At the present time, when the necessity for fire-resisting construction is becoming more and more recognised, it is clearly desirable that the continued employment of a highly inflammable material in roof design should be discouraged, at any rate, in cities and towns.

Apart from the flat roof-frame, which, from the structural standpoint, is analogous to a floor, and the *lean-to* frame, the most simple form of roof truss is that described as the *couple* (see Fig. 78).

Strictly speaking, however, this is not a truss, because the two sloping rafters do not constitute a rigid and unyielding frame. On the contrary, they are bound to spread under the influence of load, thus exerting pressure upon the supports in an outward direction. Consequently a roof embodying rafters so arranged comes under Class II., as defined in paragraph (1), p. 53 *ante*.

By the addition of a tie-beam securely connected to the foot of each rafter, as in Fig. 79, the lateral spread is counteracted, and the frame so formed may properly be designated a truss. A roof having framework of this type is known as a *tied-couple roof* or *couple-close roof*, and comes under Class I. of the general classification above mentioned.

The tie-beams are generally of timber, because they can be used as supports for the ceiling. One disadvantage that follows the application of timber ties is that they are apt to sag slightly, and therefore tend to pull the walls inwards.

This effect can be prevented by the application of a further member to the truss connected with the ridge at the top and with the tie-beam at the bottom. The vertical member is termed a *king-post*, and Fig. 80 represents the most simple form of king-post truss.

When a truss of the construction here illustrated is employed in wide spans the permanent and occasional loads cause flexure in the rafters to such an extent that intermediate support is necessary between the ridge and the lower extremity of each rafter.

Horizontal struts, as in Fig. 81, might be introduced with good effect, but a far better method of affording the requisite support is to apply diagonal struts or braces, as shown in Fig. 82, which represents what is usually understood by a king-post truss, a form of construction suitable for roofs up to about 30-ft. span.

We have traced the development of the king-post truss from the simple couple without

Premises: Nos. 41 & 43, Maddox-street. Mr. W. S. Weatherley, F.R.I.B.A., Architect.

alluding to alternative methods of treatment, the object being to make clear the defects of the more simple types of truss and the manner in which such defects can best be remedied.

In some cases where it is thought desirable not to obstruct the interior by a tie-beam at the level of the side walls the two rafters forming a *couple* are connected by a *collar-beam* fixed about midway between the top of the walls and the ridge (see Fig. 83). A beam so applied acts as a strut or as a tie, according to circumstances. Assuming the walls to be capable of resisting the outward thrust of the rafters, the collar-beam constitutes a strut affording intermediate support for each rafter. On the other hand, assuming the walls exhibit a tendency to yield under the outward thrust of the rafters, the collar-beam acts as a tie with regard to the upper portion of the truss, but, of course, can have very little beneficial influence in the way of reducing the outward thrust exercised by the lower part of either rafter.

Collar-beam trusses, as illustrated in Fig. 83, do not represent good construction, and are not suitable for roofs of more than

about 18 ft. span. Even when so used the dimensions of the rafters must be proportioned with due regard to the length of their free ends, and the walls must be of ample strength so as to withstand outward thrust without appreciable movement.

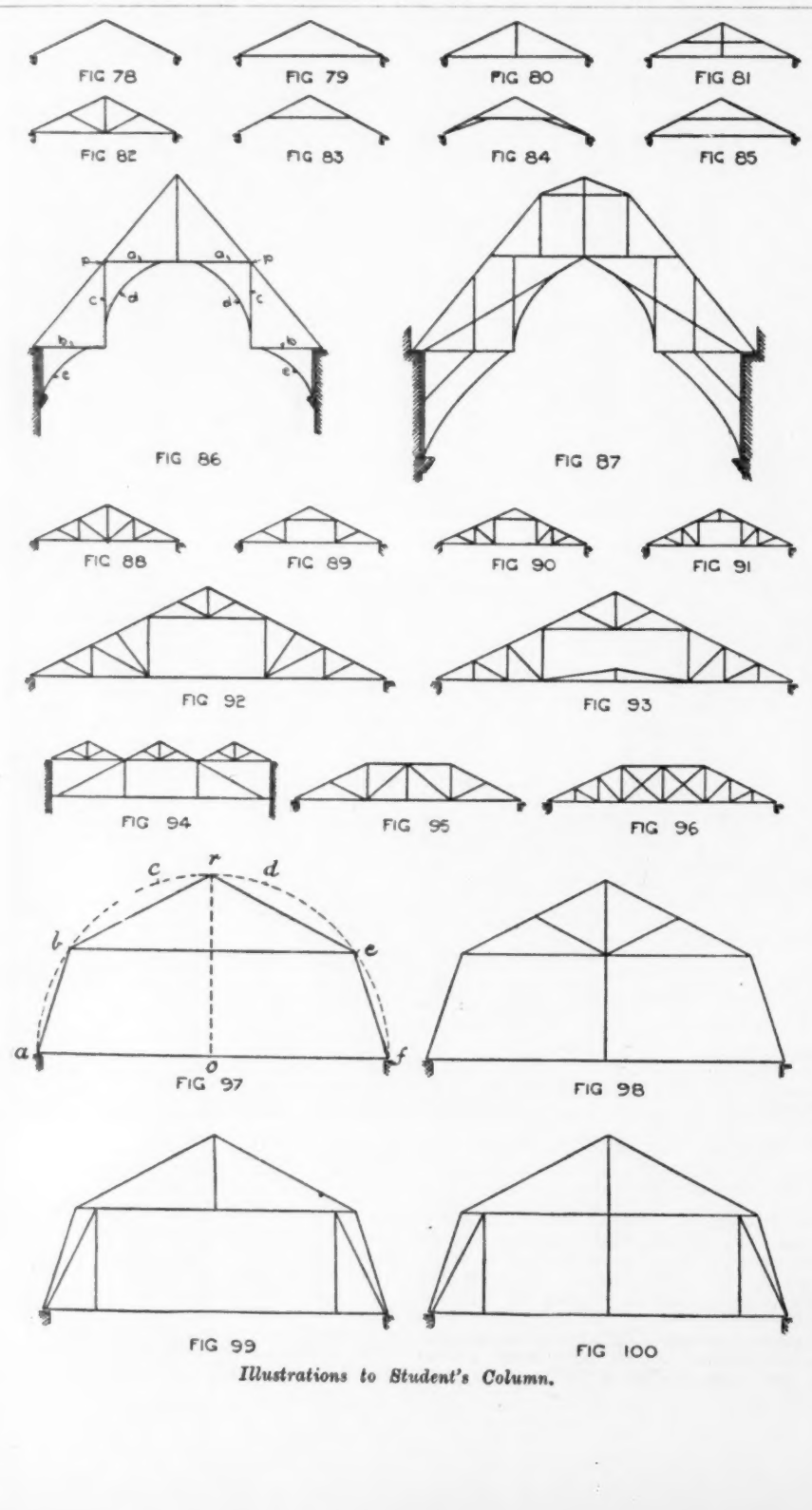
Fig. 84 shows a modification of the collar-beam truss, where tension members are fixed so as to tie the free end of each rafter to the collar-beam with the object of making good the weakness of the truss at its lower part. A still better form of construction is to employ a tie-beam as well as the collar (see Fig. 85), but, of course, the latter member does away with the only advantage to be derived from the substitution of the collar-beam for a king-post and diagonal bracing. When applied in conjunction with a tie-beam the collar-beam becomes a strut.

The *Gothic roof* illustrates the application of the collar-beam in conjunction with a *hammer-beam* attached to the foot of each rafter. In Fig. 86 *a*, *a* is the collar-beam, *b*, *b* are hammer-beams, *c*, *c* are struts. The three triangles formed by these members and the rafters would turn about the points *p*, *p* if not kept rigidly in position by something more satisfactory than the stiffness of the rafters.

A truss of this type can be rendered stable (1) by the application of tension members *d*, *d* connecting the hammer-beams with the collar, (2) by the application of compression members *e*, *e* resting upon corbels and acting as struts against the underside of the hammer-beams, or (3) by a combination of ties and struts.

The adoption of method (1) makes the truss a self-contained structure exerting pressure on the supporting walls in a purely vertical direction. Where method (2) is employed outward thrust is exercised by the roof truss, and the walls must be of adequate strength. In cases where the two methods are applied in conjunction matters are somewhat complicated, and it is not always easy to analyse the stresses actually developed.

We may cite the roof of the great hall at Hampton Court Palace as an example, illustrating the use of ties and struts in conjunction. The construction of the roof is diagrammatically represented in Fig. 87. All the members are so strong and so securely connected that if the bottom struts were taken away it is probable that the tension members would prevent the exercise of injurious thrust against the walls. On the other hand, as the weight of the roof is carried down so far below the hammer-beams by the wall-posts, the walls would be capable of resisting any strain following the removal of the tension members.



Illustrations to Student's Column.

Referring to Fig. 86, it should be pointed out that the hammer-beams *b*, *b*, although occupying positions usually associated with ties in the roof system, are really levers. The inner end of each beam carries half the weight of the upper portion of the roof, a load that is balanced to some extent by the weight of the rafter at the outer end of the beam. Of course, the additional force required to establish equilibrium is furnished by the tie *d* or the strut *e*, or by *d* and *e* in conjunction.

Reverting now to the king-post truss, as illustrated in Fig. 82, we must point out that this form of construction is only suitable for roofs of comparatively small span. When the span exceeds about 30 ft. it is found necessary to provide additional supports for the tie-beam and additional diagonal struts to stiffen the rafters.

In Fig. 88 the two vertical ties on either side of the king-post are termed *queen-posts*.

By leaving out the king-post and substituting a horizontal strut termed a *straining-beam* between the two remaining verticals, we have the *queen-post truss* (Fig. 89), which may be applied with confidence to roofs up to about 45 ft. span.

A convenient feature of the queen-post truss is that it affords space for the formation of rooms in the roof of a building.

For spans exceeding 45 ft. wide two intermediate supports are not enough for the tie-beam, and the queen-post truss is elaborated by the addition of other verticals distinguished by the term *princess-posts*, or simply *princesses*. A diagram of the modified design will be found in Fig. 90, this form of truss being suitable for roofs up to 60 ft. span. In cases where the straining-beam is of such length that there is risk of sagging, a small king-post is fixed between it and the ridge, as indicated in Fig. 91.

By extension of the principles outlined above timber trusses could be constructed of any span within the limits imposed by the mechanical properties of the material.

As the span increases the necessity becomes evident for additional members to support the rafters and tie-beam.

Assuming it were decided to design a timber truss of about 70 ft. span, the rafters between the ends of the straining-beam and the ridge would be stiffened by diagonal struts connected at the foot of the small king-post shown in Fig. 91, and those portions of the rafters between the queen-posts and the rafters would be supported by additional struts. Fig. 92 represents the truss as so modified.

In cases where the tie-beam requires further support the number of princess-posts can be increased, and that part of the tie-beam between the queen-posts can be stiffened by the addition of two ties and a vertical strut forming a rigid truss. The construction would then be as drawn in Fig. 93.

Another form of truss suitable for wide spans is that in Fig. 94, where three small king-post trusses are carried by a deep girder, which is practically a large queen-post truss with the apex removed and the addition of an upper horizontal beam, acting as a compression boom. The construction here illustrated involves the use of heavy timbers and extension of the walls above the level necessary for other types of truss previously described.

Fig. 95 shows a flat-topped truss having two queen-posts, one king-post, with two diagonal struts for supporting the straining-beam, and the usual struts as intermediate rafter supports. This form of truss is also suitable for wide spans.

Fig. 96 illustrates a somewhat similar truss for still wider spans, having two queen-posts, four princess-posts, a king-post, a double system of diagonal bracing in the two central panels, and single bracing in the outer panels.

The *Mansard*, or *curb*, roof, permitting the construction of a capacious and well-lighted attic story, is much used in this country, and under the name of the French roof has been very popular in the United States for many years past.

The usual method adopted in setting out the profile of a Mansard roof is that of Belidor, a distinguished French engineer, who lived a century and a half ago, and whose writings on timber construction remain

of practical value for the guidance of architects and engineers to the present day.

The method, illustrated by the broken lines in Fig. 97, is as follows :—

Bisect the line *af*—representing the span of the roof—at *o*, and draw the line *or* perpendicular to *af*. Upon the base *af*, with the radius *oa*, describe the semicircle *arf*, and divide it into five equal parts, *ab*, *bc*, *cd*, *de*, *ef*. Join *ab* and *ef* to give the sides of the lower portion of the roof, and *br* and *er* to give the slope of the upper portion.

The simple form of Mansard truss illustrated in Fig. 97 comprises two outer struts, a lower tie-beam, an upper tie-beam connecting the rafters, and a small king-post between the ridge and the upper tie-beam. The last-mentioned member is not shown in the diagram, because it would interfere with the broken line *or*.

A stronger form of the same kind of truss is shown in Fig. 98, where a stout king-post is carried from the apex down to the lower tie-beam, and two diagonal struts are added to provide intermediate support for the rafters.

Further rigidity is imparted by adopting the system of bracing in the lower portion of the truss as represented in Fig. 99. By carrying the king-post down to the lower tie-beam, as in Fig. 100, still further strength can be added to the construction, and if thought necessary diagonal struts can be included for intermediate support of the rafters.

Numerous other diagrams might be added of timber roof trusses suitable for different styles of architectural design, for wider spans than those hitherto contemplated, and for adoption in special circumstances. As the architectural consideration of roofs is beyond the scope of these articles, and as the modern tendency is to employ steel construction except for trusses of very moderate span, we have confined attention in the present article to typical examples most likely to be of use in ordinary structures.

Next week we shall take up the discussion of the details of simple forms of timber roof trusses.

Builders' and Contractors' Column.

THE CONSTRUCTION OF A TUBE RAILWAY.—III.

(Continued from page 276.)

Tunnelling with a Shield.

SHIELDS are chiefly employed for the purpose of supporting the ground and providing a protection for the men employed during the operations of excavating and fixing the iron lining of the tunnel; they also assist to a certain extent in the work of excavation, although the greater portion of this is done by hand labour.

The shields employed for tunnelling in London clay may be divided into two classes—(1) the small shields used for driving the running tunnels, and (2) the large shields used for stations and cross-over roads; these two classes, although similar in principle, differ considerably both in construction and in the method of working.

Considerable improvements have been made in the small shields since the first were used on the City and South London Railway, the most notable being the substitution of mechanical power for hand labour for moving the shields forward.

The shield now used for driving the running tunnels consists mainly of a cutting-edge, a skin, and the jack-castings and diaphragms forming the main support of the shield. The outside diameter is 2 in. larger than the outside diameter of the tunnel lining, and the over-all length is about 7 ft. 6 in.

The cutting-edge is of cast-steel, constructed in three sections bolted together, and is slightly larger in diameter than the skin in order to facilitate the passage of the shield through the clay.

The skin, which is about 6 ft. long, consists of a cylinder, constructed of ½-in. steel plates, with butt-joints and cover-plates, and extends from the cutting-edge, to which it is bolted, backwards beyond the ring of jack-castings for a distance of about 2 ft. 9 in., forming what is known as the "tail" of the shield. The object of this tail is to support the ground and protect the miners whilst erecting the iron lining.

Immediately behind the cutting-edge is a steel diaphragm, composed of two ½-in. steel plates, and behind this, again, are the jack-castings, which are bolted together, and form the chief support of the shield, as well as providing a firm fixing for the jacks.

The shield is driven forward by hydraulic rams or jacks, eight in number, having a stroke of 24 in. and a diameter of 7 in. Each ram can be operated independently, or the whole or any number can be operated at once, being controlled by a system of valves. On the upper part of the diaphragm an air-engine, or intensifier, is fixed, which is supplied with compressed air at a pressure of 60 lb. per square inch, and which raises the pressure, or intensifies it, to 2,240 lb. per square inch, at which pressure it forces water into the rams. The compressed air for working the intensifier is supplied by air-compressors, and installed on the surface, and is led to the shield in air-tubes along the tunnel already constructed, being connected to the intensifier by a flexible hose. The water for the rams is drawn from and returned to two tanks fixed on either side of the shield.

The shield is fitted with an oak grouting-rib, made in sections, placed in the tail of the shield between the ram-heads and the last ring of tunnel segments fixed. The grouting-rib serves a double purpose; firstly, it prevents the grout from running out until it has set, and secondly, it distributes the pressure from the ram-head more evenly over the cast-iron segments.

The total force which can be exerted by the rams for driving a shield for a 12 ft. 6 in. tunnel forward is about 300 tons, or about 7½ tons per foot run of cutting-edge; but in practice the force required generally varies between 150 tons and 250 tons.

A box-heading, strongly timbered, about 6 ft. high by 5 ft. wide, is driven ahead of the shield, and is always kept about 6 ft. or 8 ft. ahead of it. The heading is excavated by hand labour; two miners and two labourers working in it continuously, even whilst the shield is in motion, being just able to keep pace with the progress of the shield.

The cycle of operations for each ring is as follows :—

Let us assume that the shield is all ready to move forward, then the condition of affairs will be as follows :—The last ring of iron erected has been bolted up and grouted, the grouting-rib is in position, and is held there by the rams. The clay has been roughly trimmed to the shape of the cutting-edge for a distance of about 20 in., and the requisite number of piles have been placed in position. (Note.—The piles are of oak, about 3 ft. long by 6 in. by 2 in., and are shod with iron; they are placed against the front of the cutting-edge parallel with the skin of the shield, with one end resting in a small pocket cut in the clay face. The object of the piles is to burst out and bring down as much as possible of the clay between the cutting-edge and the box-heading as the shield moves forward, and the number used varies with the nature of the ground.) Planks have been placed from the heading to the platform of the shield to prevent the clay knocked out by the piles falling into the invert. The first two settings of the box-heading have been knocked away and placed across the entrance of the heading to protect the miners in it from the falling clay. All being ready the pressure is turned on, the rams commence to work, and the shield moves slowly forward. If the tunnel is straight the shield is allowed to advance the full stroke of the rams, but when on a curve the shield is stopped at half-stroke for the purpose of checking it for position.

At the end of the stroke the shield is stopped, the front portion being filled with loose clay knocked down by the piles. The pressure is reversed and the rams are drawn back and the grouting-rib removed; the invert of the tail of the shield is then cleaned out ready for the iron lining to be placed in position. Whilst the shield has been moving forward the segments, six in number, and the key-piece and bolts for one ring of tunnel have been brought up to the shield on trollies ready for fixing.

The two bottom segments are first placed in position in the invert, the wood packings are inserted in the circumferential joints, and the segments are then bolted up to the last ring fixed. The two side plates are then dealt with in a similar manner. A temporary stage is constructed about 5 ft. high to enable the miners to fix the two top-plates and the key; these are lifted on to the stage, and the lower end of each segment is placed on the top of the corresponding side-plate; the upper end is supported temporarily on a timber strut, and is forced upwards tight against the skin of the shield, being about 1 in. above the final position; the key can now be inserted, and when this is done the struts are removed and the two top-plates are allowed to come down into their correct position, gripping the key on either side. The whole ring is then bolted up and the stage removed.

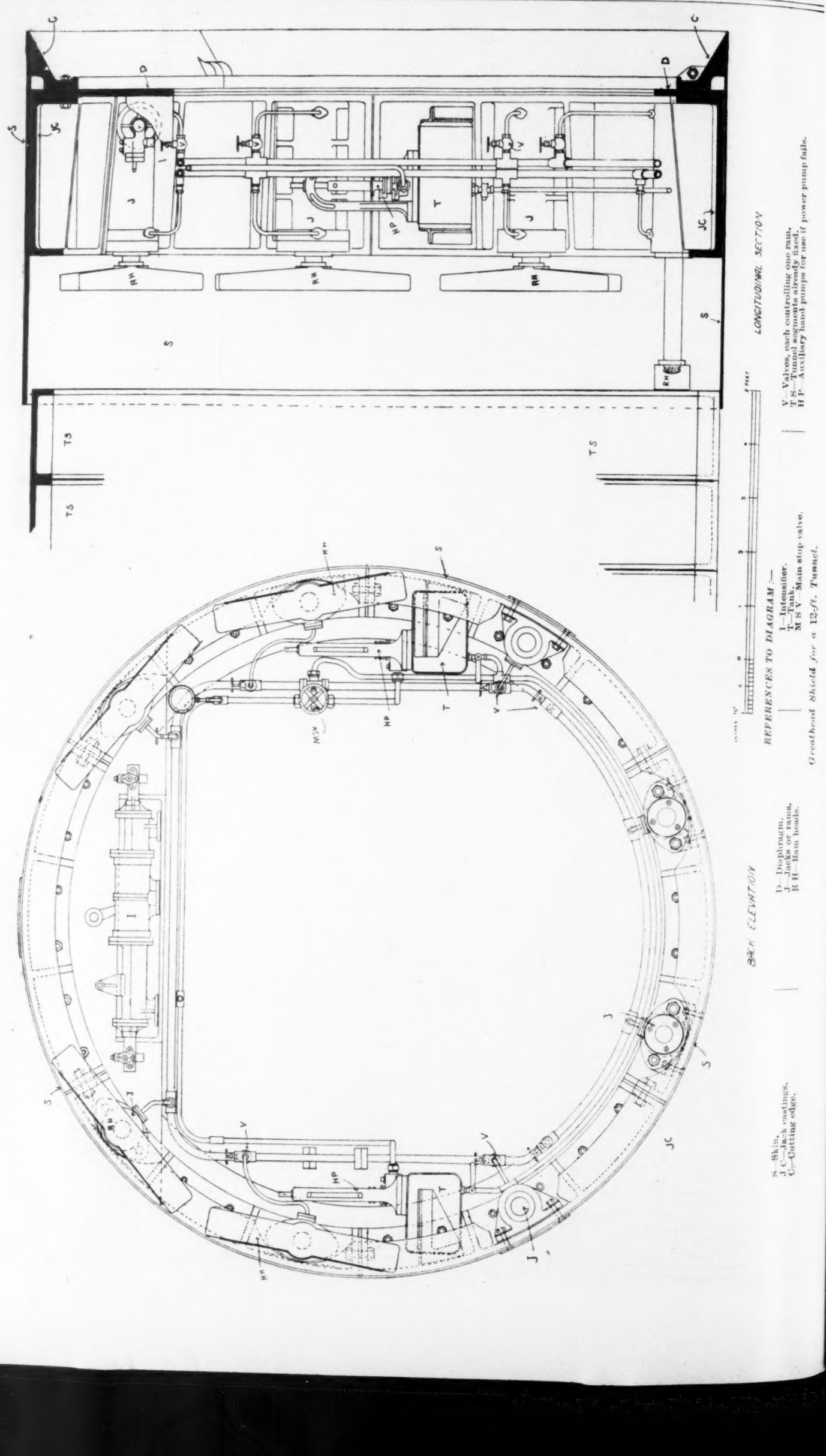
Whilst these operations have been in progress the miners have continued to work in the heading, and at the same time two men, using the heap of loose clay in front of the shield as a platform, have trimmed the ground out ahead of the shield for a distance of 20 in., and have refixed the piles ready for the next move forward. The loose clay is now removed from the shield and heading and the ring of segments grouted, and the cycle of operations is complete.

Forty rings a week is good progress, working night and day continuously.

Grouting.—This operation, which has been mentioned several times in these notes, is a most important one, as the safety of the buildings, mains, etc., along the route largely depends upon the manner in which it is done. The materials used vary considerably, the following having been used at different times :—Neat cement, neat blue lias lime, cement and lime in varying proportions, cement and sand, and lime and sand, in all cases having a considerable quantity of water with them. The grouting-pan consists of a strong steel cylindrical vessel, about 2 ft. 6 in. long and 1 ft. 6 in. diameter; a horizontal shaft runs through the centre, fitted with a number of blades, and is revolved by means of a handle. At the bottom of the cylinder is a nozzle, with screwed connexion, to which an armoured hose is coupled, the free end being held in the grouting-holes left in the tunnel segments. On the top of the grouting machine is a valve and screwed connexion, which is connected to the high-pressure air-main in the tunnel by means of a length of flexible armoured hose. There is also an opening in the top of the machine fitted with an air-tight door. The operation of the machine is as follows :—The cement or lime is placed in the grouting machine through the opening in the top and the necessary amount of water added, the handle being revolved meanwhile in order to agitate the mixture and prevent it setting. The air-tight cover is then securely screwed down, and the valve turned on, which admits air at a pressure of 60 lb. per square inch into the upper part of the machine, forcing the grout out of the lower nozzle through the hose to the space outside the cast-iron lining of the tunnel, which it completely fills.

Packings.—In order to prevent the grout running out between the rings of segments creosoted deal packings are inserted in the circumferential joints. These packings are cut to the pattern of the flange of the segments, and have holes bored in them to correspond with the bolt-holes in the segments. The packings vary in thickness from ⅛ in. to 1½ in., the thinner ones being used where the tunnel is straight and thicker ones where the tunnel is on a curve.

Guiding a Shield.—A tunnelling-shield has to be steered in two directions, viz., vertically and horizontally, and great care is needed to keep the shield in its correct position. For the purpose of checking the vertical movements of the shield adjustable boning-rods are used. These are fixed as follows :—One on the shield itself, one about ten rings back from the shield, and one about twenty rings further back; they are bolted to the top of the tunnel, and the adjustable cross-pieces are levelled with a dumpy level, so that the tops of the two boning-rods in the tunnel should line exactly with the rod in the shield. Should the shield be low the top rams are shut off and the bottom ones used to force it upwards, and in the same way, if it is too high, the bottom rams are closed and the top ones used. When the


LONGITUDINAL SECTION
BACK ELEVATION
REFERENCES TO DIAGRAM :—
I—Intensifier.
T—Tank.
M S V—Main stop valve.
V—Valves, each controlling one ram.
T S—Tunnel segments already fixed.
H P—Auxiliary hand pumps for use if power pump fails.
D—Diaphragm.
J—Jacks or rams.
R H—Ram heads.
S—Skin.
J C—Jack castings.
C—Cutting edge.
Greathead Shield for a 12-ft. Tunnel.

tunnel is on a gradient the two boning-rods are set at such levels that the shield will follow the correct gradient if the rods bone through.

For controlling the horizontal movements of a shield two methods are employed. The first method is as follows:—Two plumb lines are suspended from the roof of the tunnel about 30 ft. apart, the leading line being about 10 ft. behind the shield; the lines are placed in position exactly on the centre line if the tunnel is straight, or on the tangent line if the shield is travelling round a curve. A movable centre-rod is attached to the shield, having the exact centre of the shield marked upon it. The plumb lines in the tunnel are set with a theodolite after careful calculations. To test the shield for position on a straight length the plumb lines are allowed to hang freely, and the centre-rod is placed in position in the shield; if the shield is correct the two lines will be in alignment with the centre mark on the shield-rod, and if the shield is off line more rams are used on one side in order to bring it back again. For checking the shield on a curve a table of offsets is calculated for every foot on the tangent line, which show how much the shield should be to the right or left of the tangent line at any point on the curve. If the shield is off line it is corrected in the same manner as when on the straight.

The second method was conceived by Mr. Dalrymple-Hay. In this method two guide-rods, about 25 ft. long, are attached to the back of the shield, and are drawn forward by it as it moves. The rods are divided into feet and inches, and pass along over two indices fixed in the tunnel, one on either side, square to the centre line. Now, if the shield is travelling correctly, the readings of the guide-rods at both sides of the tunnel should be the same, but if the shield is going off line one reading will be higher than the other. When going round a curve a special shrunk-scale is calculated for the rod on the inner side of the curve, so that both rods should still read the same when on a curve. The chief advantage of this method over the first one described is that the readings can be taken while the shield is in motion, and indicate much more quickly if the shield is travelling off the line.

Architectural Societies.

ARCHITECTURAL ASSOCIATION. — The proposed week-end visit to Chichester, announced in our "Meetings" column last week, did not take place owing to the want of a sufficient number of entries.

Correspondence.

REASON AND TRADITION.

SIR,—May I make a few belated notes which have occurred to me with reference to your interesting articles on "Reason and Tradition"? It has seemed to me that certain of the arguments put forward on behalf of reason apply to the architecture of Greece and Rome equally with that of mediæval Europe. Tradition unchecked and reason paramount appear rather to figure in all three, and never has any one of them been bound by rigid formulæ.

I am sometimes tempted to think of all architecture as Classic until the Renaissance made itself felt. The "great divide" seems most to lie in the fact that architecture previous to the Renaissance was unconscious, and afterwards it was not. When I have stood in Florence within the Church of Santo Spirito or before the Ruccellai Palace I have been immediately aware of some new element for the first time ranging itself alongside of tradition. I recognise an intruding personal force in the design, and often something that I can speak of only as sheer invention. The forms might doubtless be traced back to a traditional base, but they compel you to accept them on their merits. The sacristy of San Lorenzo presents a more notable instance still. As the late Charles Garnier said, "Michelangelo made his architecture."

I recall, also, an address you once gave, in which you cited examples of the daring with which individual designs had treated detail popularly supposed to be inviolate. This visible human element was, of course, no new thing. One cannot conceive of architecture existing without it. Yet it had previously presented itself, as it seems to me, in what I may venture to call a "soluble" form—saturating tradition, while the Renaissance crystallised this into the personal.

We cannot now return to the unconscious days of innocence did we desire it. The very effort to do so would betray our self-consciousness. To lead "the simple life" we must be simple people, and this must be also the first step towards reasonable architecture. Our materials cannot teach us to be that, though they will willingly assist us. Neither can tradition be clipped like a yew hedge. To learn resource from it here, and restraint there, and freedom everywhere offers greater opportunities, as I think, towards the formation of a national architecture, though the growth be slow, than can be hoped for by establishing an aristocracy of style drawn from one source or the other, and, if I am not mistaken, the evidences of such a natural growth are apparent to-day.

C. J. T.

ESTIMATING FOR EXCAVATION AND CONCRETE WORK.

SIR,—In your issue of September 15, under the "Builders' and Contractors' Column," you give two examples of estimating for a cubic yard of concrete; but I am at a loss to understand why you divide by 6 in the second example, as, inasmuch as you have added 15 per cent. for shrinkage, should not the division be by 7? Again, if you assume that the 7 yds. of dry material have shrunk 15-100ths, the amount to add to bring up to its original amount will be 1-5·66th of the balance of 85-100ths; also, I notice, you have added the 15 per cent. on to the labour, which, I think, is not usual, 1s. 6d. being a fair allowance for mixing and depositing a cubic yard of concrete when set in the work.

The method adopted by the writer, working on your prices, would be as follows:—

		s.	d.
6 yds. ballast 6s.	=	36	0
1 yd. cement	=	32	11
7		68	11
Shrinkage, 15 per cent. = add $\frac{1}{6.66}$		12	2
Divide by 7		81	1
		11	7
Add labour, etc.		1	6
		13	1
10 per cent. profit		1	4
As against your 16s. 5d.		14	5

The statement that a ton of cement is actually only 1-12th of a cubic yard is, of course, a misprint. It will naturally depend upon the weight of the cement, which varies, the average being about 100 lb. to the cubic foot, equals $\frac{100 \times 27}{2240}$, say, 1 1-10th tons to the cubic yard.

The writer has found, by repeated actual experiment, that concrete material, composed of two parts broken granite 1¼ in., one part granite dust, one part sharp red sand, one part Portland cement, all by measure, when dry will shrink as much as 32 per cent. when set in the work, and, generally speaking, the finer the material and the more cement used the greater the shrinkage.

Perhaps some of your other contributors will give your readers the value of their experience, which, I feel sure, would be of interest to many beside myself.

HARRY A. DIX, A.M.I.C.E.

Leicester.

*** The "one-twelfth" should have been "eleven-twelfths." It was written in figures in the "copy," not in words, hence the printer's mistake, which we regret not having noticed.—ED.

BOOKS RECEIVED.

BUILDING CONSTRUCTION AND DRAWING: ELEMENTARY COURSE. By Charles F. Mitchell. Seventh Edition, revised. (B. T. Batsford. 3s.)

THE EDUCATION OF AN ARTIST. By C. Lewis Hind. (Adam & Charles Black. 7s. 6d.)

BUILDING CONSTRUCTION (ADVANCED AND HONOURS COURSES). By Charles F. Mitchell. Fifth Edition. (B. T. Batsford. 5s. 6d.)

Fifty Years Ago.

FROM THE *Builder* OF SEPTEMBER 20, 1856.

CESSPOOLS IN PARIS AND LONDON.—Paris, to the eye, is a very clean city: London, judged by sight alone, is very dirty. We must, however, again refer to the returns of the Registrar-General for practical results; and then we find that, although the metropolis of Great Britain numbers more than double the population of Paris—though we have a damp, dull-looking, smoke-laden atmosphere, and a foul river—we nevertheless have a lower rate of mortality. There must be reasons for such a result, if we can find them. Let us examine one set of works, and analyse the regulations under which they are used, striving to see if anything useful can be learned. The River Seine is not contaminated by sewage as the River Thames is, although there would be no tidal return and oscillation. The buildings of Paris do not drain into sewers, but the whole of the house-soil and slop refuse is passed into *pseudo*-hermetically-closed cesspools. These cesspools are constructed under regulations, and the superintendence of the municipal body or their officers. They are also emptied by the same authorities, and a very large return is obtained by sale of the manure after it has been deodorised. The system is considered perfect by its supporters: it has been lauded by public writers; and those who only judge from surface appearances conscientiously think the Paris plan of cesspool sewerage should be imitated. But these gentlemen have probably never lived long in Paris; or if they have resided there, it has not occurred to them that the sharp and subtle stench now and then met with can have anything to do with the cesspools; neither are they conscious that such a stream of gas may be more deadly than a wound by a naked sword. The French pay a terrible penalty for their cesspool system. Their clear atmosphere and clean river do not save them from the subtle, unseen, but most deadly gases of decomposition. This cesspool taint must have something electric in it, as it pervades all available space. On a bright warm day the doors and windows of a house may stand open from morn to night without bringing relief: it is not to be blown out. The boasted hermetical sealing is only a delusion and a snare. Fermentation takes place, and the gases of decomposition force a passage through every chink and cranny, as also back along the pipes and ducts which convey the refuse. There is no such thing as a "stench-trap" in existence, nor ever will be. As previously stated, the Paris cesspools are emptied by servants of the municipal body, and no doubt many persons consider that to empty a cesspool is, for a time, to remove the cause of contamination. This, however, is not so. The sides of a cesspool are foul from infiltration, the bottom is never entirely cleared from sediment, and there is soon a covering of liquid, so that there is a larger area of decomposition, and more cubical space for the deadly gases generated. A cesspool must be a foul abomination, if near a human dwelling, under any management. London is not without cesspools: there are thousands beneath dwelling-houses, and connected with them; but, fortunately, they never became municipal property. The small area covered by the City, and the defective powers of parish boards beyond City limits, have probably saved the English people from constructions so fatal to health and life. Better all the soil refuse of a city in the gutters, on the surface, or in the river, where the sun may dry it, the air ventilate it, the rain wash it, and the river dilute and remove it, than stored in cesspools, to undergo continuous fermentation and decomposition; but better still the instant removal of all soil and slop refuse (before decomposition commences), by means of drains and sewers, to some common outlet, where it can be applied at once to land for agricultural purposes. To obtain such results will be worth almost any pecuniary cost, supposing the whole outlay to be a loss; but, like all true improvements, such plan is the most economical.

"MOTTOES ON MANTELPIECES."—The last line of the inscription over the fireplace at Aston Hall should have run:—"To serve doe not disdaine" instead of "does" as printed.

Illustrations.

ORGAN, CHELTENHAM COLLEGE CHAPEL.

THE new organ, built in the west gallery of the chapel, is a large instrument, measuring 27 ft. across by 12 ft. 6 in. deep, and is 41 ft. high. It is by Messrs. Norman & Beard, of Norwich and London.

The case, which is a memorial to the late Dr. Dyer, is of English oak, and was carried out by Messrs. R. L. Boulton & Sons, of Cheltenham, from the design of Mr. H. A. Prothero (Messrs. Prothero & Phillott), Cheltenham.

COMPETITION DESIGN FOR THE PALACE OF PEACE AT THE HAGUE.

THIS design, in a Greek-Renaissance style of architecture, is intended to illustrate the international and world-wide purpose of the institution.

The main idea finds expression in the circular form of the plan, presenting to all nations from every side an equally dignified façade.

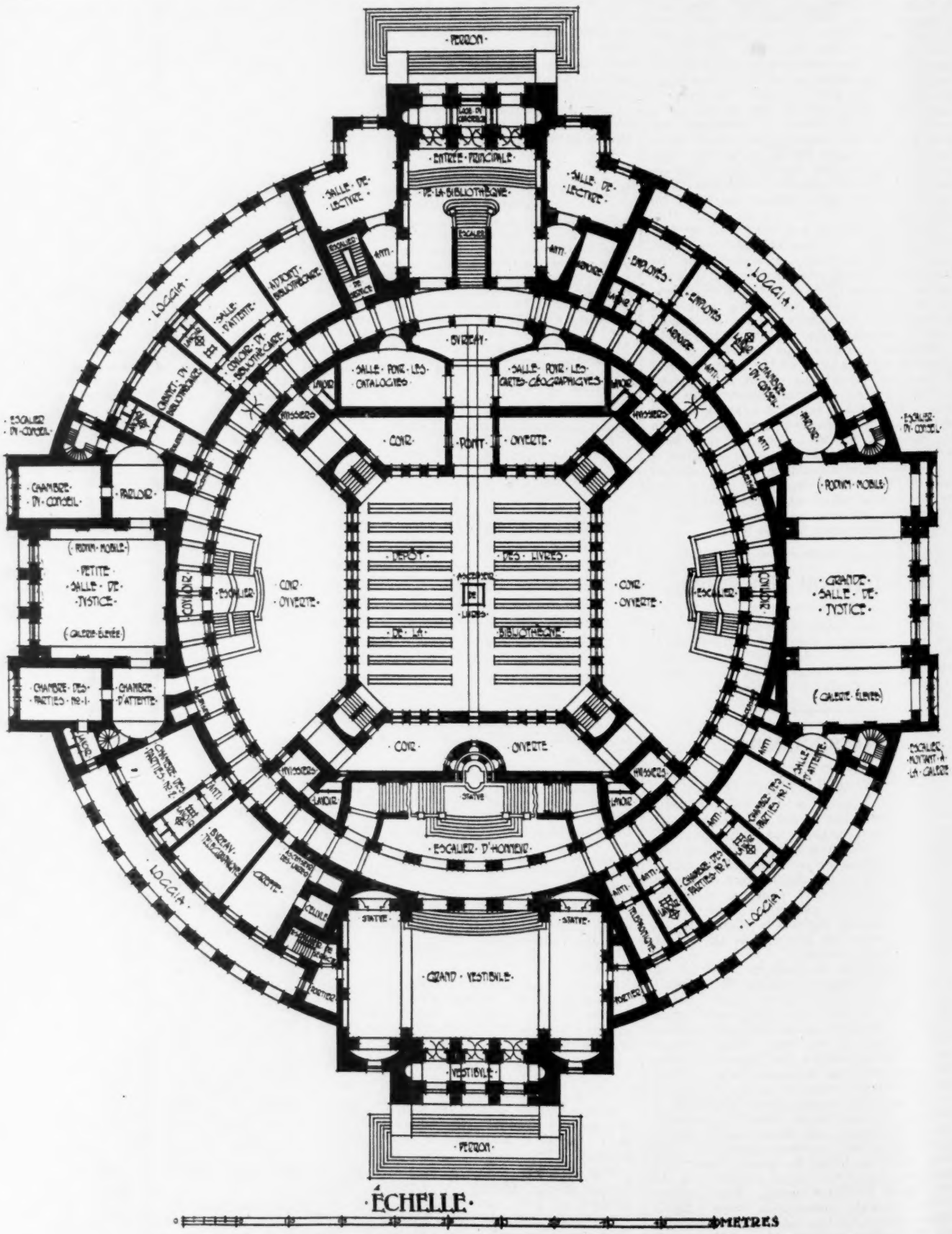
The books of the library are stored in a separate building in the centre of the Palace, and, though isolated from it by open courtyards, access is obtained by means of a bridge and circular corridors.

The perspective view was executed by Mr. H. F. Waring, and valuable assistance was rendered by Mr. J. F. Watkins in the preparation of the drawings

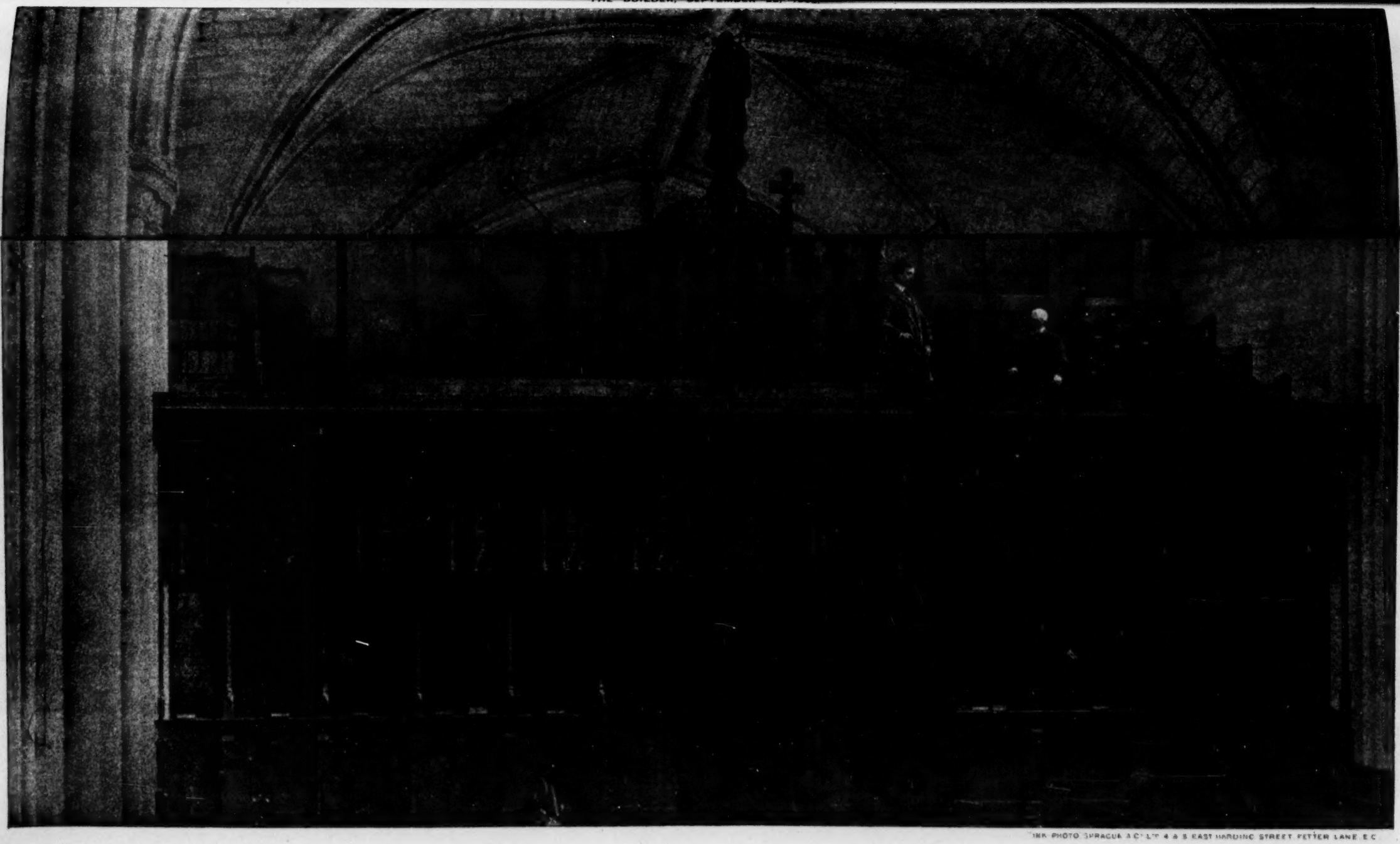
G. A. BLIGH LIVESAY.

CITY CHAMBERS, LEEDS.

THESE premises are in course of erection upon one of the very best sites in the city, at the junction of East-parade, Bond-street, and Infirmary-street, the frontage line having been set back about 30 ft. Between the old and new buildings there was a street 12 ft. wide, which has been abandoned. The ground floor will be occupied by insurance offices, and the upper floors by professional men. The front is in Doulton's Carrara, and the floors are being erected on the Kahn system of reinforced concrete



Competition Design for Peace Pa'ace at The Hague. Plan of Principal Floor.



INK PHOTO SYRACUSE & C° LTD 4 & 5 EAST HARDING STREET FETTER LANE E C

NEW ORGAN, CHELTENHAM COLLEGE CHAPEL.—Mr. H. A. Prothero, F.R.I.B.A., Architect.

N FOR THE
THE HAGUE.
enaissance style
o illustrate the
purpose of the

pression in the
resenting to all
qually dignified

are stored in a
e of the Palace,
by open court-
y means of a

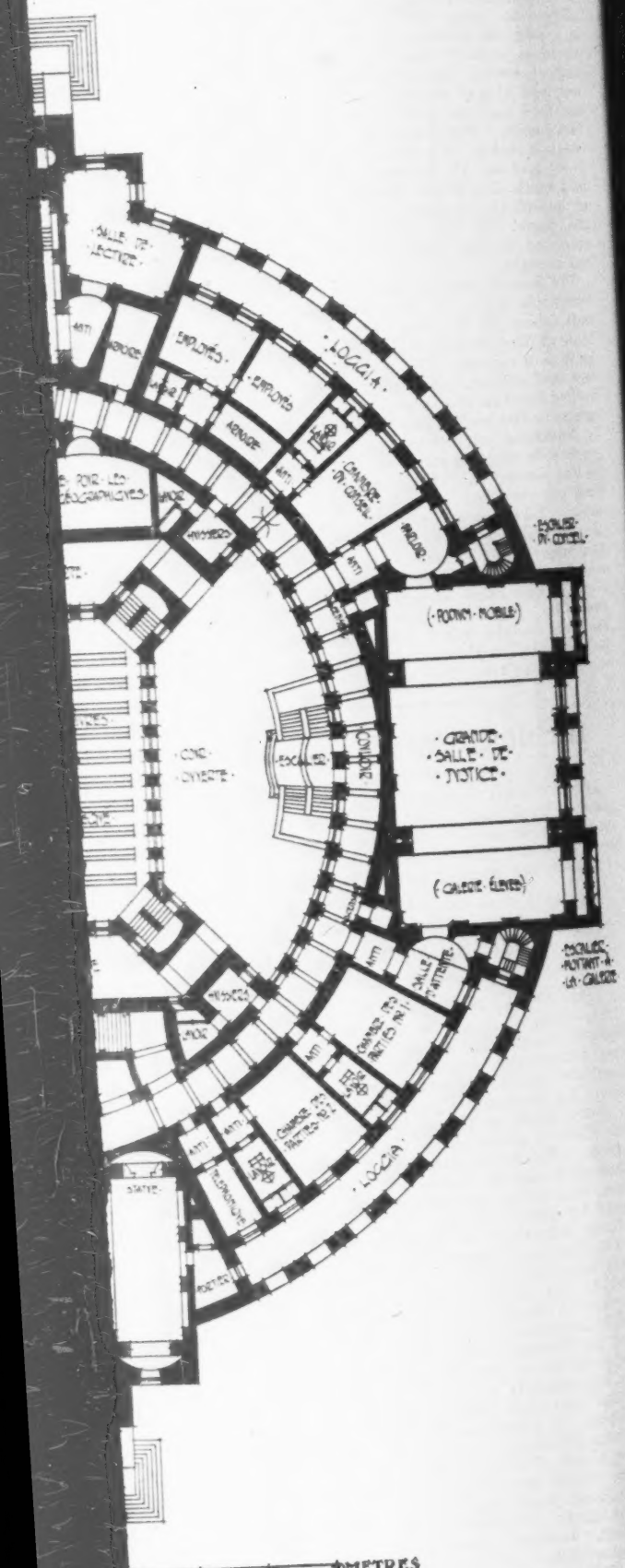
xecuted by Mr.
assistance was

rendered by Mr. J. F. Watkins in the preparation of the drawings

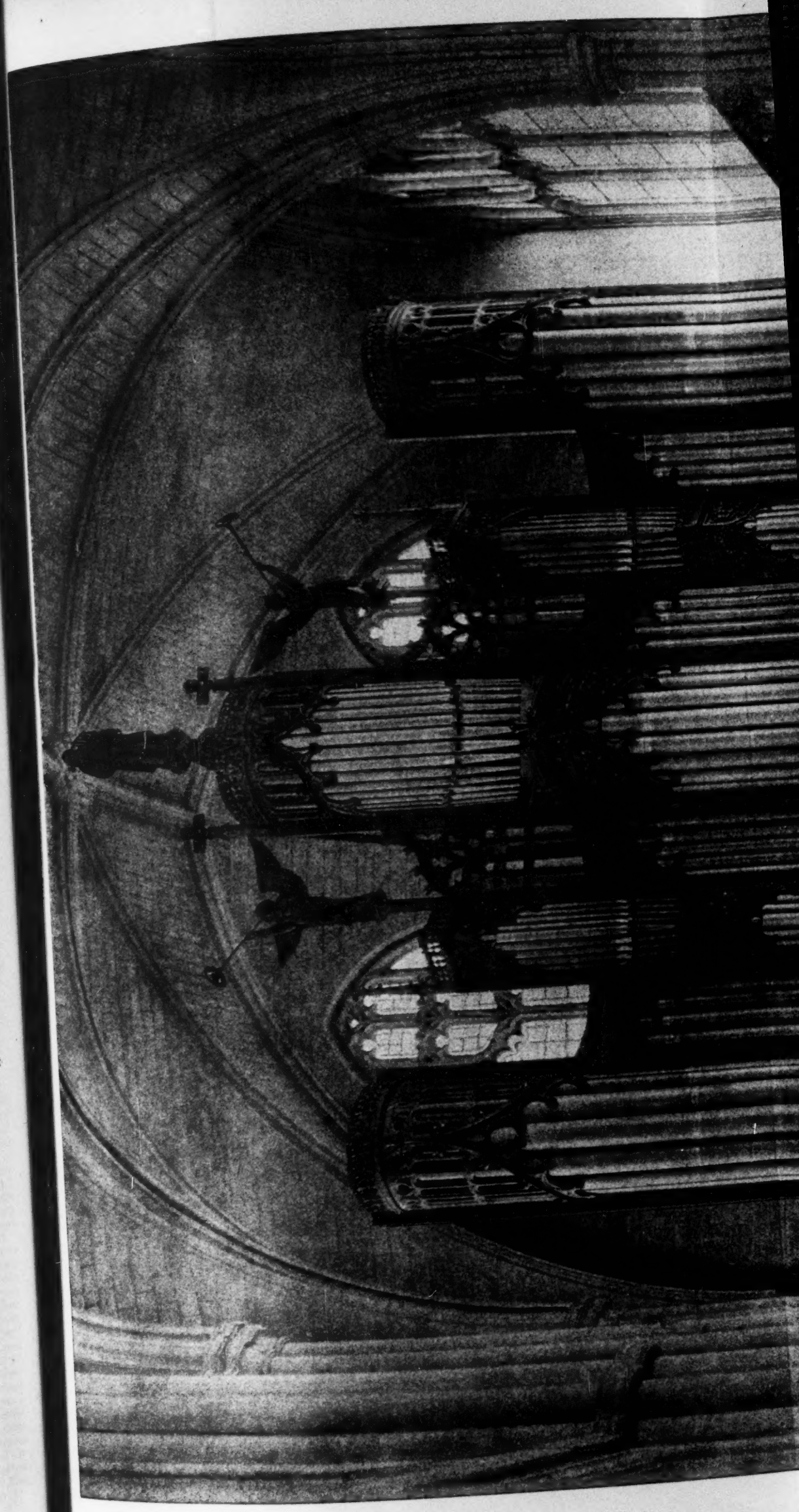
G. A. BLIGH LIVESAY.

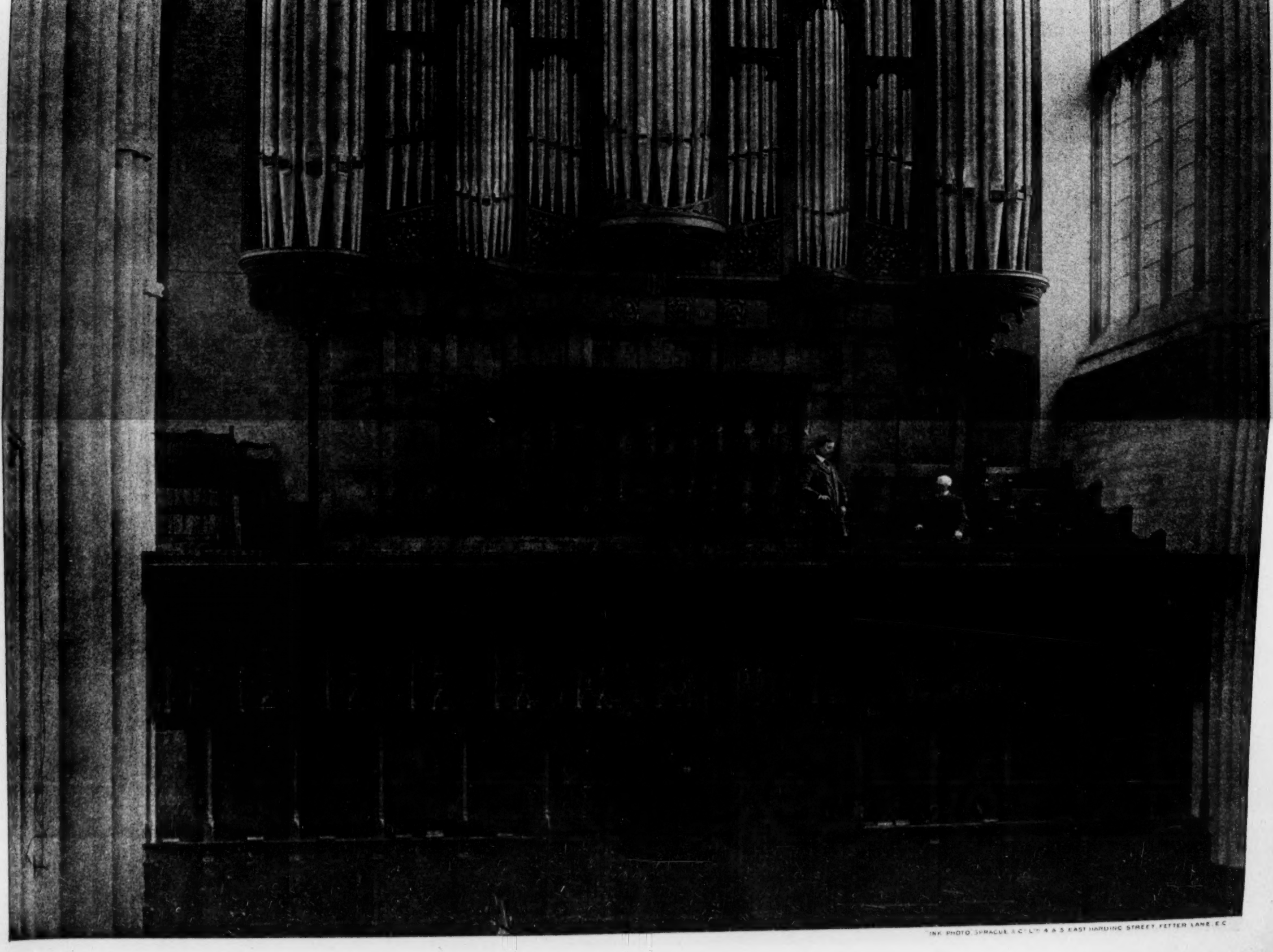
CITY CHAMBERS, LEEDS.

THESE premises are in course of erection upon one of the very best sites in the city, at the junction of East-parade, Bond-street, and Infirmary-street, the frontage line having been set back about 30 ft. Between the old and new buildings there was a street 12 ft. wide, which has been abandoned. The ground floor will be occupied by insurance offices, and the upper floors by professional men. The front is in Doulton's Carrara, and the floors are being erected on the Kahn system of reinforced concrete.



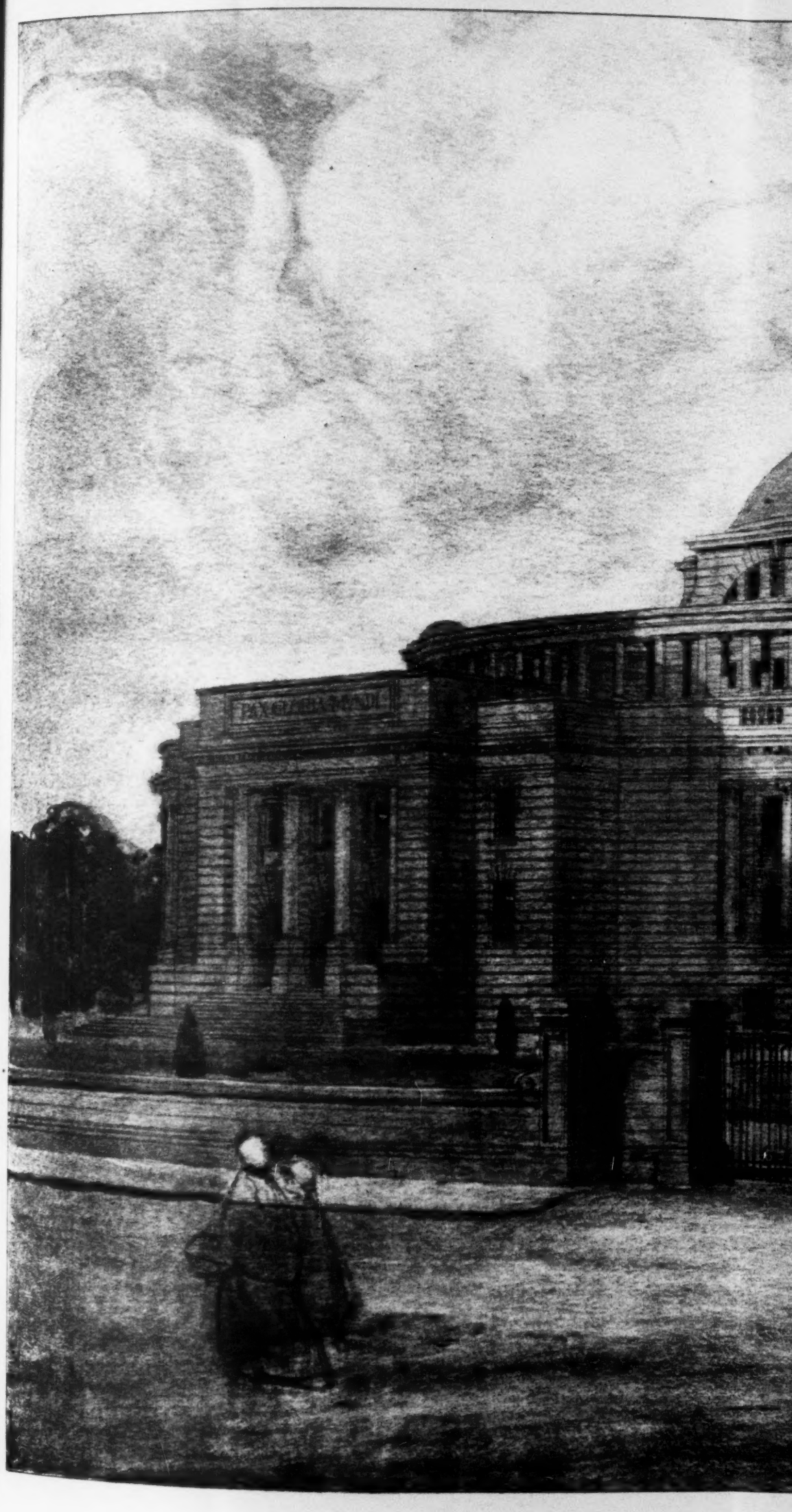
...e. Plan of Principal Floor.



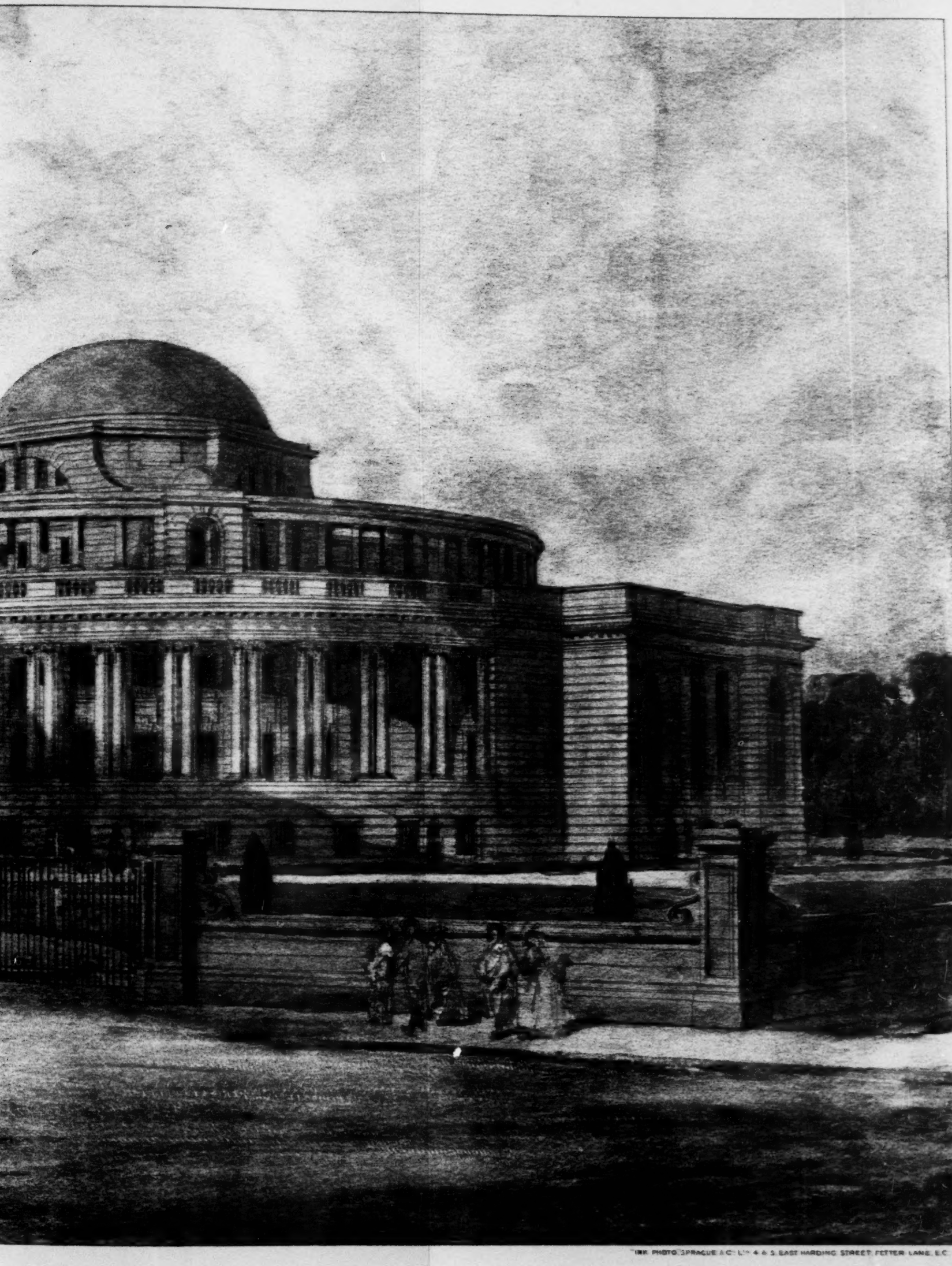


INK PHOTO SYRACUSE & C° LTD 4 & 5 EAST HARDING STREET FETTER LANE E.C

NEW ORGAN, CHELTENHAM COLLEGE CHAPEL.—Mr. H. A. Prothero, F.R.I.B.A., Architect.

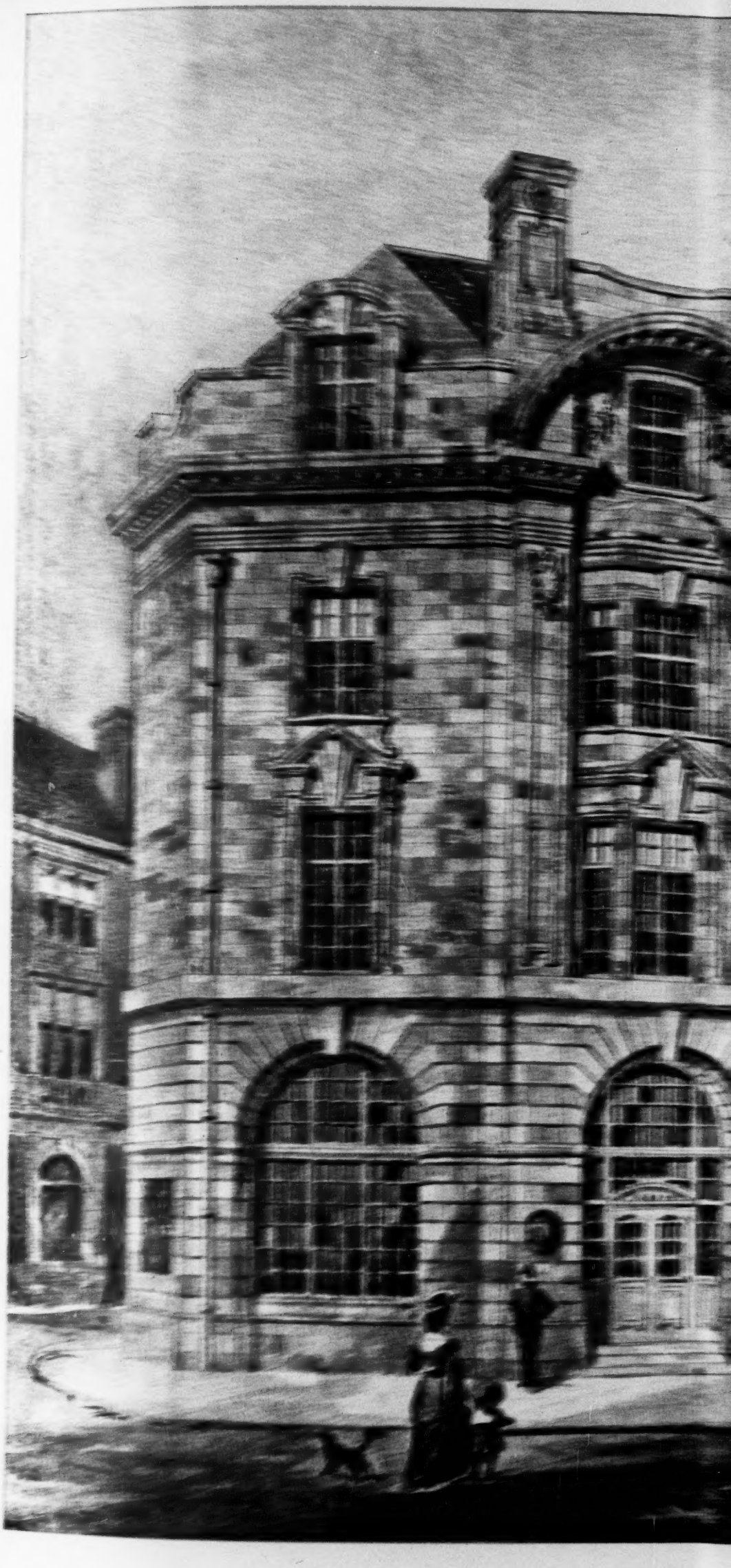


A COMPETITION DESIGN FOR THE

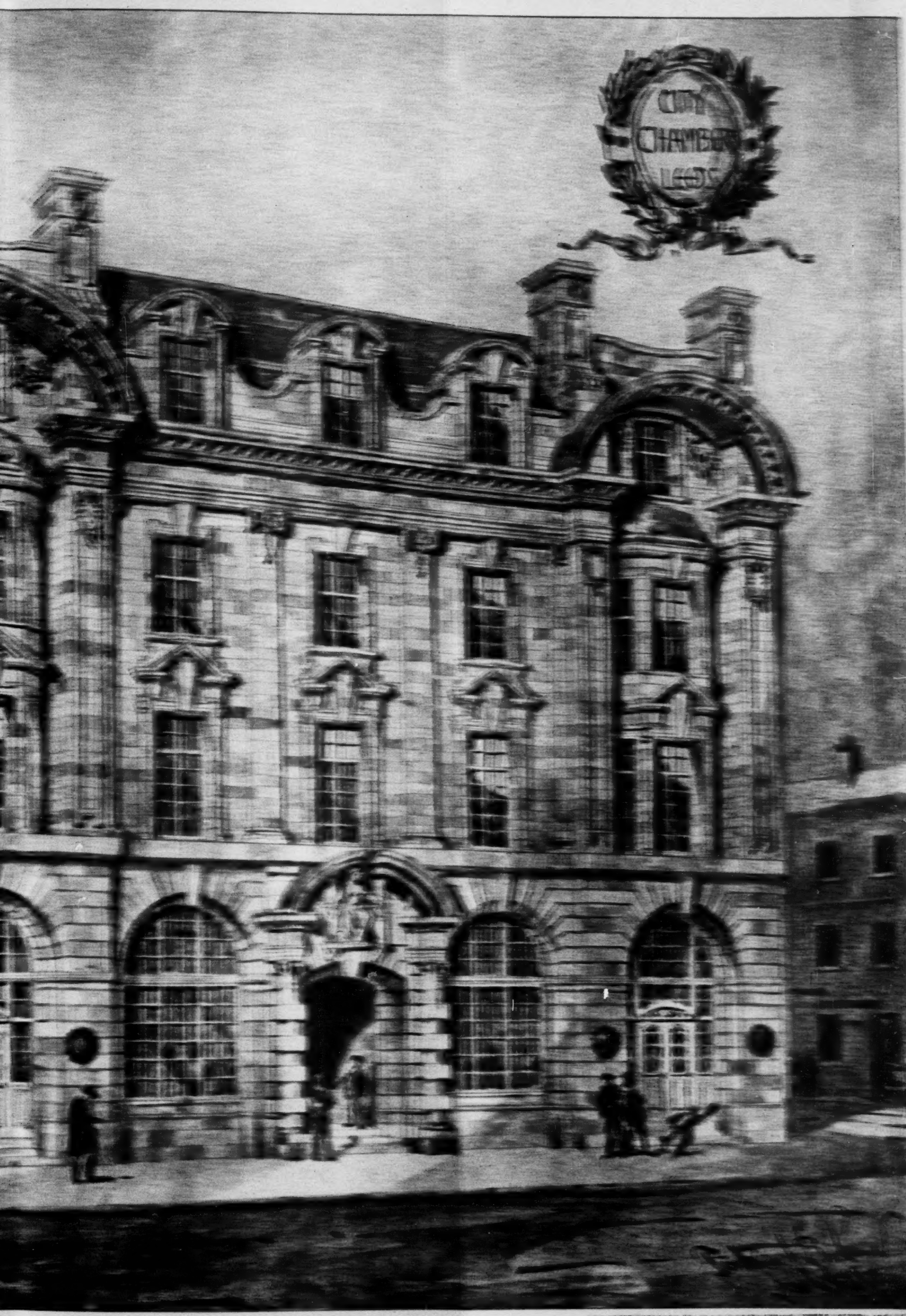


THE PHOTO PRAGUE A.C. Ltd. 4 & 5, EAST HARDING STREET, FETTER LANE, E.C.

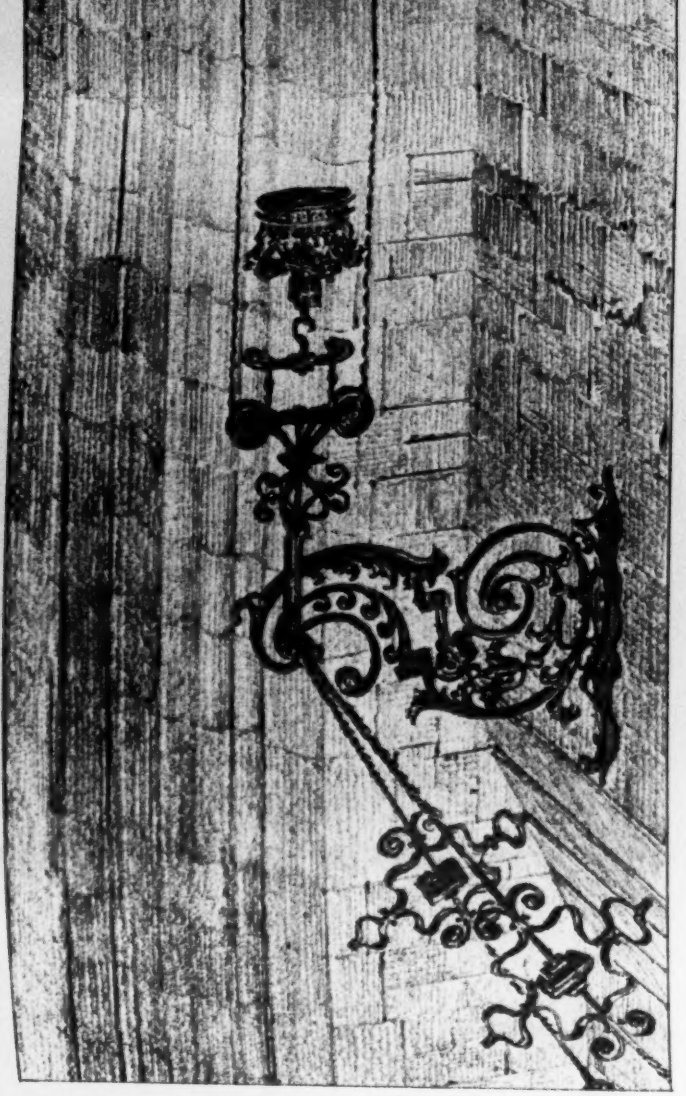
THE PEACE PALACE AT THE HAGUE.—By Mr. G. A. Bligh Livesay, F.R.I.B.A.

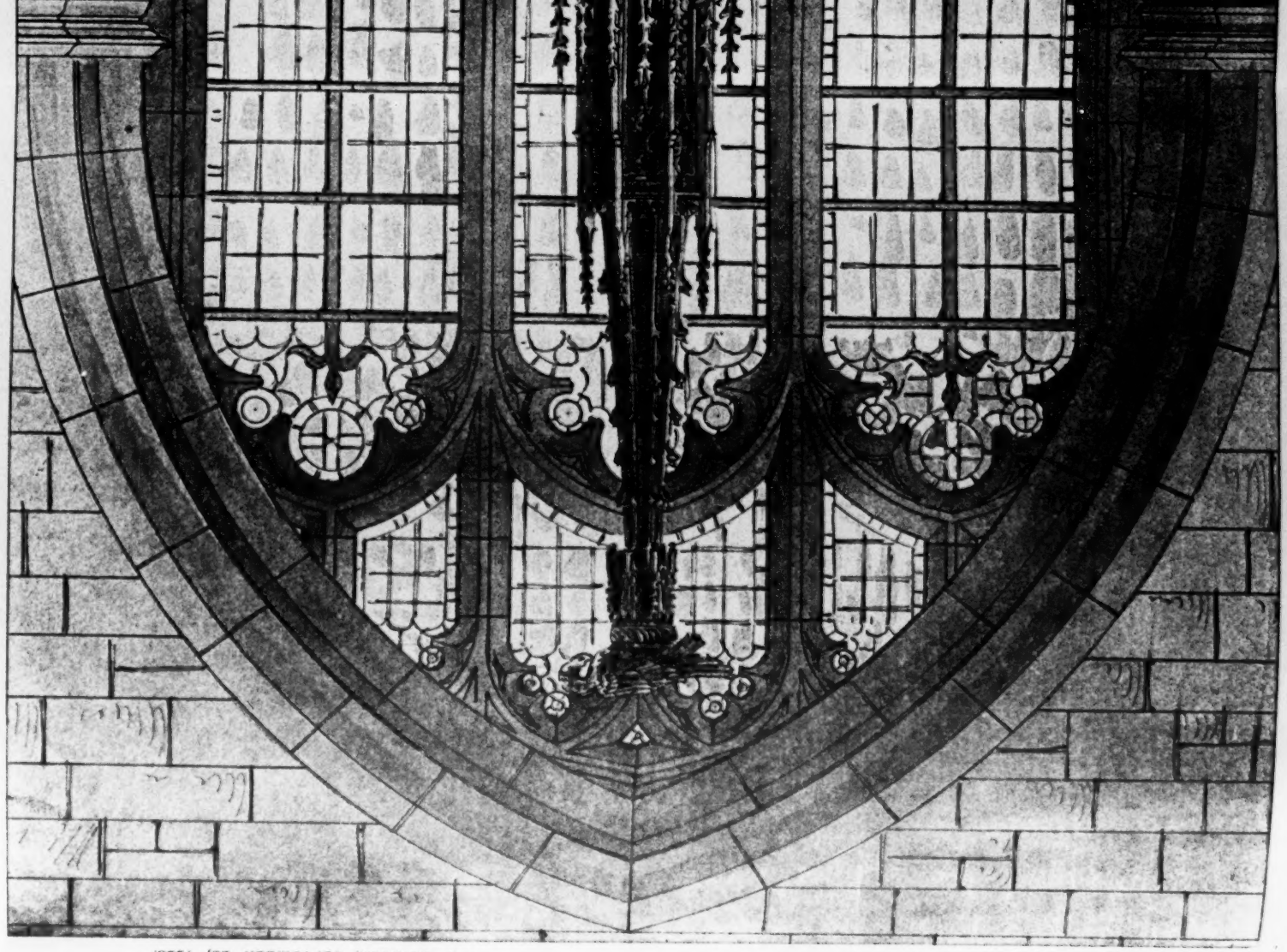


CITY CHAMB

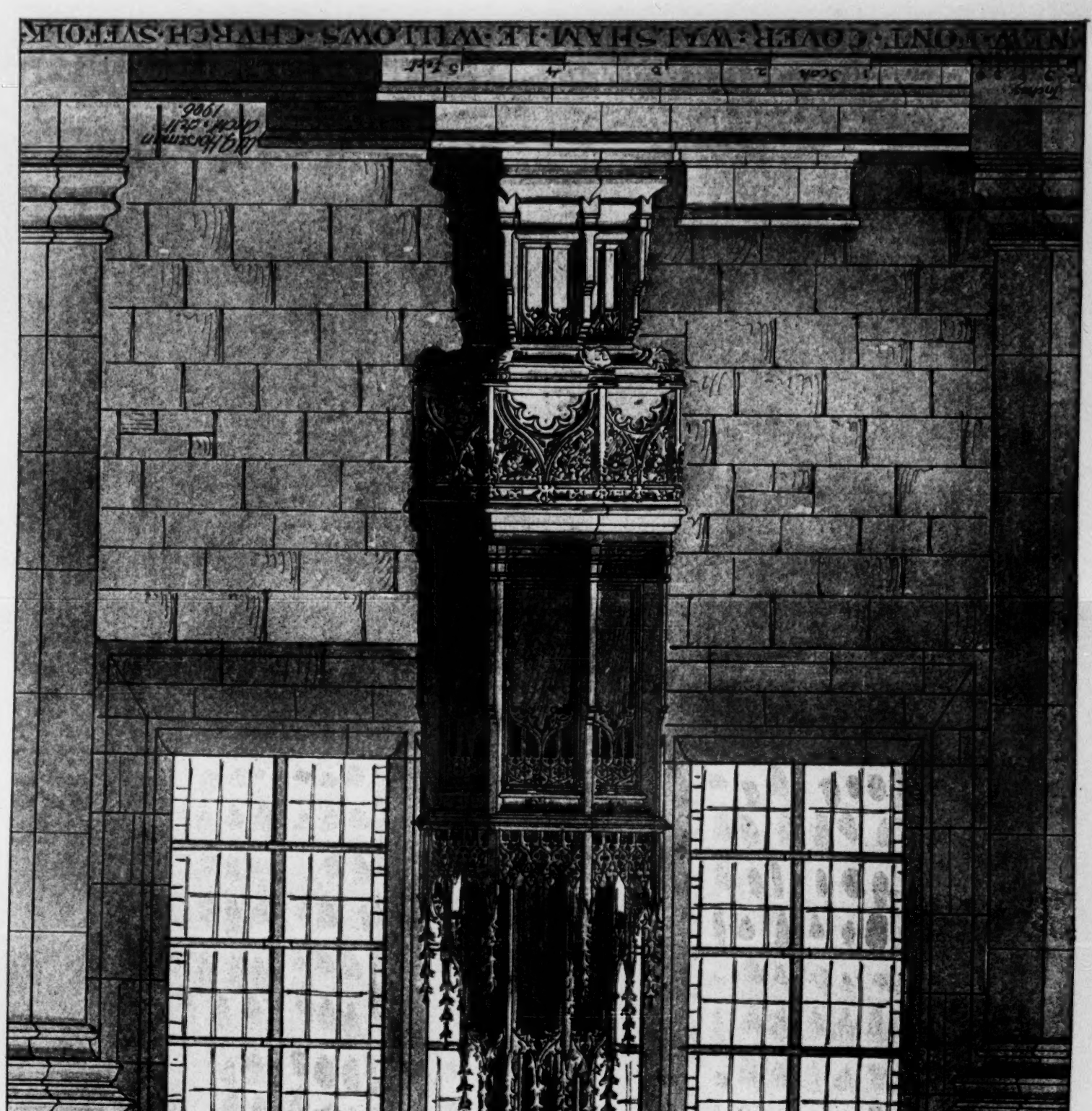


CHAMBERS, LEEDS.—Messrs. Brown & Bedford, Architects.





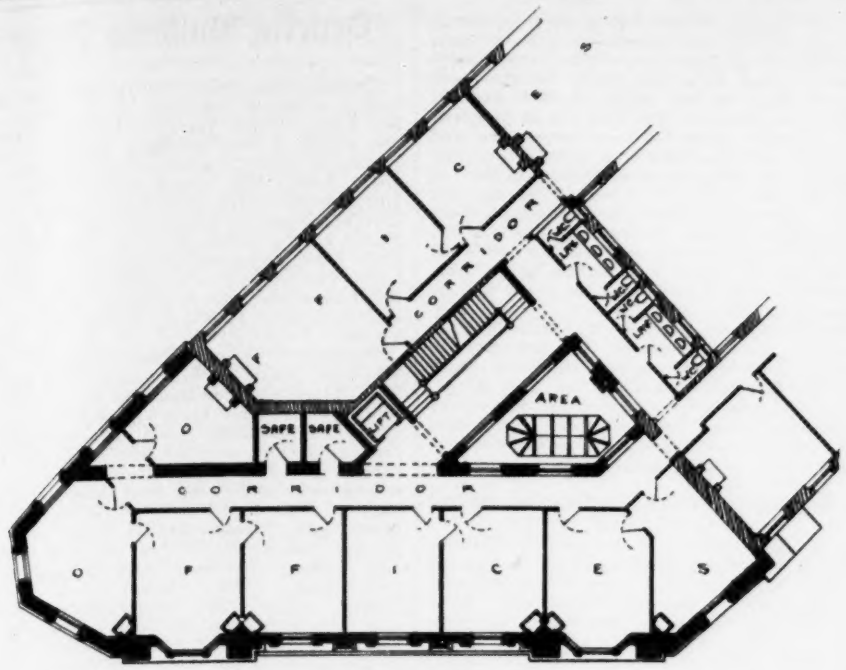
INK PHOTO SPRAGUE & C°LTD 4 & 5 EAST HARDING STREET FETTER LANE E C



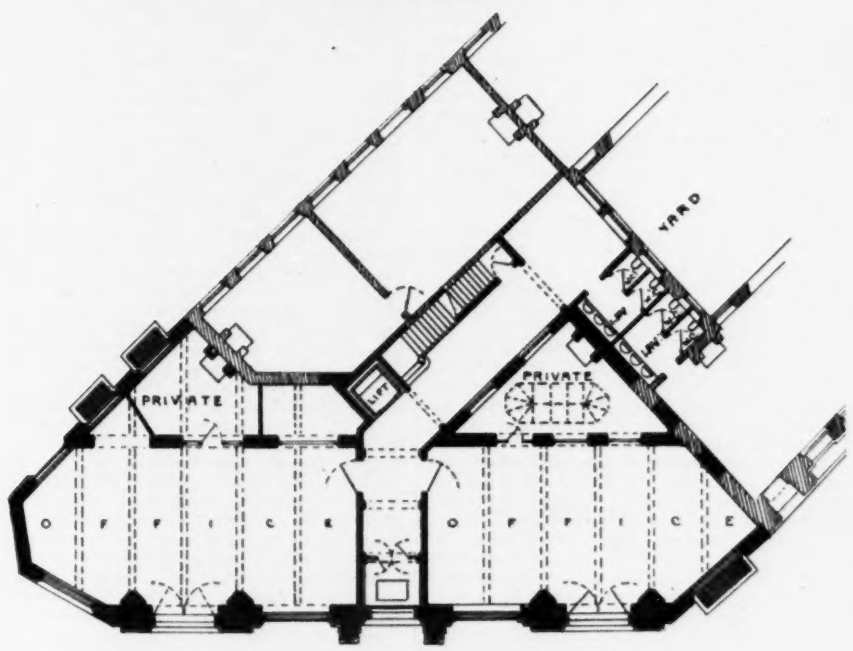
The Bulwell hills exhibi

NEW

The been XV The stag and out The cro pel bei vil the is in car sup Ho exh



— FIRST FLOOR PLAN —



— GROUND FLOOR PLAN —

Scale of 10 0 10 20 30 40 50 Feet

City Chambers, Leeds. Plans.

The architects are Messrs. Perkin & Bulmer, of Leeds, whose drawing was exhibited in this year's Royal Academy exhibition.

NEW FONT COVER, WALSHAM-LE-WILLOWS CHURCH, SUFFOLK.

THE font cover herewith illustrated has been designed in harmony with the existing XVth century font in the above church. The cover is a fixed one of oak in three stages, all of which are octagonal in plan, and the lowest stage is arranged to open outwards for the baptismal services.

The middle stage is surmounted by a crocketed spire crowned by a finial of the pelican in her piety. The whole cover is being carved by a class composed of the village lads. The font at present stands upon the floor of the church, without steps, but it is proposed to provide stone steps as shown in the drawing. The whole work is being carried out from the designs and under the superintendence of the architect, Mr. W. G. Horseman, of London. The drawing was exhibited this year at the Royal Academy.

FONT-COVER COUNTERPOISE WEIGHTS, LOUGHBOROUGH CHURCH.

THIS wrought-iron work was designed by Mr. W. Samuel Weatherley, and incorporated an old XVIIth-century bracket, which was repaired and strengthened. Mr. Page, art metal-worker, of Loughborough, carried out the work. The drawing was exhibited in this year's Royal Academy.

METROPOLITAN ASYLUMS BOARD.

THE usual fortnightly meeting of the Managers was held at the offices, Victoria-embankment, on Saturday, September 15, Mr. C. M. Martineau in the chair.

Correspondence.—A letter was received from the Local Government Board asking the Managers to reconsider their proposal for the erection of a porter's lodge and staff cottages at Joyce Green Hospital, with a view to reducing the cost of the scheme.

Darenth Asylum.—The Works Committee reported that on the 14th inst. they accepted two tenders for laundry alterations at the Darenth Asylum, viz., that of Mr. T. Knight, Sidcup, for building works at the sum of 1,016*l.*, and that of Messrs. D. & J. Tullis, Southwark Bridge-buildings, for engineering work at 2,885*l.* When asked to sign their respective contracts on the 10th inst., Mr. Knight declined, as he said he had made serious errors in his totals, the items amounting in all to 382*l.* 3s. 8d. He asked permission either to withdraw his tender or do the work for 1,316*l.* 3s. 8d., which was his original tender, 1,016*l.*, plus 382*l.* 3s. 8d.; but he subsequently agreed to reduce that item to 300*l.* 3s. 8d. The Committee had satisfied themselves that Mr. Knight had made a *bonâ-fide* error in his tender. It would be remembered that the next lowest tender was that of Messrs. J. Ellingham & Sons, Dartford, at the sum of 1,693*l.*

They therefore recommended that Mr. Knight's tender for laundry alterations at Darenth Asylum at the increased amount of 1,316*l.* 3s. 8d. be approved and adopted.

Mr. Elliott and Mr. Lyall protested against the alteration being made, as it laid the Board open to abuse in matters of such kind.

Mr. Thornley, in reply, said that they, as a Board, did not want to be unfair to anyone, and as the Committee had reported they had gone into the matter, and were of opinion that a *bonâ-fide* error had been made, he considered that, in fairness, they should accept the explanation.

The recommendation of the Committee was adopted.

HOUSING OF THE WORKING CLASSES IN MIDDLESEX.

IN the annual Report of Dr. Young, the Medical Officer of Health for the County of Middlesex, recently issued, he says, referring to the Housing of the Working Classes Act, that remarks are made in the reports of the local medical officers of health and sanitary inspectors in the county to the following effect:—In Brentford, Dr. Bott states that the "housing question" has always been a difficulty owing to proximity to London and the large number of workmen engaged in the town. He thinks the extension of tramways and cheapening of railway communication should induce workmen to go further afield. He also advocates the widening of the High-street because all the old and bad property in the town is in its vicinity, and if the street were widened to 80 ft. this property would have to be pulled down. In the Chiswick report reference is made to two schemes which were mentioned in last year's Report. In the case of one of these it is stated that the houses have been thoroughly repaired and are now in a habitable condition. The other scheme, known as Strand-on-the-Green, has not yet been dealt with. In Edmonton it was decided that, in order to carry out by-law No. 113 made by the District Council as regards new streets and buildings (which requires that no new dwelling-house shall be let or occupied until it has been certified after examination by an officer of the Council to be fit for human habitation), the Medical Officer of Health should give this certificate. All new houses were therefore visited by him. Certificates were granted after the first inspection in 234 cases, and after a second inspection in thirty cases. In one case a conviction and penalty was obtained against an owner who allowed his houses to be occupied before receiving this certificate. Closing orders under the Housing of the Working Classes Act were obtained in respect to three houses, and notices were served as regards two which were not fit for human habitation. In Finchley the inspector reports that, owing to failure of an owner of seven houses to carry out requirements of the authority, the works were executed by the district Council, and the cost recovered. In the report on Hayes Urban District, Dr. Higginson states that cottage accommodation is rapidly becoming more adequate; previously such has been much needed. Dr. Fletcher Little, in his report on Harrow, sets out some suggestions for the amendment of the existing by-laws. In the report on the district of Heston and Iselworth, Dr. Steegmann directs attention to the advantages of the system now in force, whereby, before a certificate is given as regards the fitness of a new house for habitation, the drains are tested by an official of the Public Health Department in conjunction with the Surveyors' Department. For the newly-created Urban District of Ruislip Northwood, new by-laws relating to streets and buildings were being framed. Dr. Ransome again repeats his remarks as to the necessity of providing suitable dwellings under the Housing of the Working Classes Act for working men in the district of Southgate. Dr. Gunther, in his report on Teddington, advises the District Council to consider the question of providing suitable cottage dwellings for the working classes in view of the fact that available sites are getting scarce and more expensive. In Tottenham twelve houses were closed as being

unfit for human habitation. The estate which is being developed by the London County Council progressed rapidly during the year, and it appears that within eighteen months it is anticipated that houses for an additional 5,000 persons will be completed. Other houses are also being erected by the Governors of the Peabody Donation Fund. In the case of Wealdstone Dr. Butler draws attention to the bad construction of some of the flats in the poorer parts of the district. He especially mentions Canning-villas; these, he states, were the subject of a special report in the previous year, but nothing appears to have yet been done, and he reports that, in his opinion, they are not fit for human habitation in their present condition.

THE ROTHERHITHE TUNNEL.

THE members of the Society of Engineers, on Wednesday, the 19th inst., paid a visit to the works of the Rotherhithe Tunnel, now in progress, of which the following is a description:—

The work, which is being carried out by the London County Council, consists of a carriage and footway tunnel, with approaches, commencing in Lower-road, Rotherhithe, and terminating in Commercial-road, Stepney. The total length is 6,883 ft., of which 2,020 ft. is open approach, 1,122 ft. cut and cover, and the remainder, 3,741 ft., tunnel, lined with cast-iron and concrete. There are four vertical shafts. One on each bank of the river near the water's edge, and one at each end of the iron-lined tunnel further inland. These shafts vary from 70 ft. to 100 ft. in depth; they are each 50 ft. diameter inside, the sides consisting of two steel skins, 5 ft. apart, with the intervening space filled with concrete. Openings are provided in the shafts for the tunnel; these openings are temporarily closed while the shafts are being sunk, and until the tunnel is connected up with them. The under-river portion of the tunnel is about 1,500 ft. long between shafts, and crosses the river diagonally in order to clear the entrances to the Surrey Commercial and the London and India Docks, which lie opposite each other at this point of the river.

The tunnel proper is circular in section, the outside diameter of the cast-iron lining being 30 ft., with a thickness of metal of 2 in. under the river, and 1¾ in. elsewhere. The lining is put together in rings each 2 ft. 6 in. wide, and composed of sixteen segments, with a key-piece. The rings are bolted together by means of bolts through the internal flanges which have a depth of 14 in. These flanges will be hidden when the work is completed by the concrete lining, which will have an internal diameter of 27 ft. The faces of the iron at the joints are all machined for a width of 12 in., and the segments fit metal to metal. The remaining 2 in. at the internal edge of the flanges are recessed for caulking with lead and rust cement.

The tunnel is being constructed by the shield system under compressed air. A small pilot tunnel, 12 ft. 6 in. external diameter, was first driven across the river, and it is being followed by the main tunnel. The strata met with are known as the Woolwich and Reading beds, and consist chiefly of clay with beds of sand and shells, overlying a bed of marl or rock of a chalky nature. Below the last occur a compact bed of pebbles, and a thick bed of sand.

The cut and cover portion of the work consists of a brick barrel, 1 ft. 10½ in. thick, surrounded with concrete. The internal diameter of the brickwork is 27 ft., the same as in the case of the concrete lining in the iron tunnel. The surface of the roadway will be 5 ft. below the axis of the tunnel in order to obtain full advantage of the available width. This will allow of a 16-ft. carriage-way and two 4-ft. 8½-in. footpaths. Below the roadway the section provides for a subway which can be used for gas and water mains, electric cables, etc.

In the case of the open approach the section consists of concrete retaining walls with battering face, surmounted by a brick parapet. A concrete invert fills the space between the footings of the side walls, and upon this the roadway is to be placed. The tunnel faces on each side of the river are built of red Aberdeen granite surmounted with a massive granite parapet, the surface of the whole being polished. Both the cut and cover portion of the tunnel and the open approaches are made water-tight with asphalt. At one point, viz., on the south side of the river, the tunnel approach crosses the East London Railway. The crossing occurs at the Rotherhithe station, and it has been necessary to cut away a portion of the railway tunnel, build new retaining walls, and carry the new roadway across the station platforms and the rails by means of a girder bridge. At the present time the approaches and cut and cover portion on the south side of the river are nearly completed. All the shafts have been sunk, and the tunnel has been driven rather more than half-way across the river. On the north side of the river the open approach and cut and cover portion of the work are in progress. An extensive plant for air compressing and hydraulic purposes has been installed, including six air compressors capable together of dealing with 1,000,000 cubic ft. of air per hour. About half that quantity is at present being delivered into the tunnel. The contract was let to Messrs. Price & Reeves early in 1904, and the work is expected to be completed in 1909. The cost of the work will be about 1,000,000*l*.

The Engineer-in-Chief is Mr. Maurice Fitzmaurice, Chief Engineer to the London County Council, the resident engineers being Mr. E. H. Tabor, assisted by Mr. A. G. Drury, member of Council of the Society of Engineers, by the latter of whom the visitors were received and conducted over the works.

ROWNTREE'S SYSTEM OF REINFORCED CONCRETE.

THE latest novelty in the way of concrete-steel is the "improved method" suggested by Messrs. Rowntree, of York, the well-known manufacturers of cocoa and chocolate. As it may be thought that proficiency in the production of such delicacies is a doubtful qualification for architectural construction, we ought to explain that the new system emanates from the building department established by the firm at their works—presumably for the execution of repairs and the erection of additional buildings.

From drawings we have receievd it would appear that Messrs. Rowntree's method is intended as an improvement upon the Hennebique system, for it includes all the essential features of that system, and so far is sound. It embodies additional features, of which some are good in theory but inadvisable in practice, while others are apparently based upon inaccurate views as to the distribution of stresses in structural members.

The chief novelties in the first category are (1) a new form of patent bar with slightly extended surface, which, compared with a plain round bar of equal cross-sectional area, offers a greater surface for adhesion of the concrete, and increased resistance to flexure; (2) a form of stirrup with eight complete twists in the metal for the purpose of securing increased resistance to shear; and (3) the disposition of the stirrups in an inclined direction. The new type of bar suggested is open to the objection, applying to all patented devices of the kind, that any theoretical advantage promised is counterbalanced by the extra cost of specially-rolled sections, and the inconvenience and delays that usually follow the employment of materials not obtainable in the open market. The saving of metal that might be effected by the use of twisted stirrups would be a very small item compared with the labour involved in the operation of twisting, and in the advance preparation, storage, and correct allocation on the site of "purpose-made" stirrups, instead of equivalent members simply cut from a length of steel strip and bent to form as required. The inclination of the stirrups is an old idea which has been largely applied in the United States and on the Continent for many years past, and the only novelty in Messrs. Rowntree's arrangement is that the angle of 60 deg. has been substituted for the correct angle of 45 deg. There are, however, two practical objections to inclined stirrups. One is that a horizontal bearing for the longitudinal reinforcement cannot be obtained unless the bottom loop of the stirrup is forged at a suitable angle, and the other is the difficulty of ramming concrete in a satisfactory manner between and around the loops of the stirrup without disturbing its position.

In the second category of new features are curved "stiffeners" for the compression areas between the points of contrary flexure in the adjoining spans of a continuous beam, and inclined stiffeners for the compression area of a column base. These "improvements" would be essential if the areas in question were subject to tension, but only represent waste of material when applied in areas of concrete already adequate for the resistance of compressive stresses. Moreover, the beam stiffeners shown on the drawings are of the wrong form, because they follow a curve that is diametrically opposite to that indicated by the outline of the diagram of bending moments.

So far as concerns concrete-steel Messrs. Rowntree & Co. have evolved a system which cannot be recommended as it stands. If suitably modified and applied by a designer of experience, it might be adopted without risk, but even then would lead to unnecessarily costly construction.

General Building News.

CHURCH, HELLIFIELD.—On the 15th inst. the Bishop of Ripon dedicated the new church of St. Aidan, which has been erected to serve the needs of the Hellifield portion of the parish of Long Preston. The total cost is about 3,500*l*. The church consists of a nave and chancel, which will accommodate about 250 worshippers. There are also a clergy vestry and a parochial room. The tower is 55 ft. high, and is capable of holding a peal of bells. The walling is of rubble in mortar, and the furnishings are principally of oak. The architects were Messrs. Connon & Chorley, of Leeds.

WESLEYAN CHAPEL, BROCKHOLES.—A new Wesleyan chapel has been built in this village. The chapel will accommodate about 200 persons. It contains nave, chancel, minister's vestry, organ-chamber, and stone porch, with arched opening, enriched with mouldings, and carved patterns. There is also a vestry or dorcas-room under the front portion of the church. The outer walls of the church are faced with hammer-dressed local stone in random course, pointed in Portland cement, and having buttresses with dressed stone weatherings. The chancel arch is of dressed ashlar, with double-splayed jambs and drop arch, and the floors of the chancel and main aisles are of cement-concrete, stained to the colour of red tiles. The chancel ceiling is barrel-vaulted in plaster, with moulded ribs and modelled patterns. The communion rail and pulpit are in oak, the seating and open-timbered nave roof in pitch-pine, the latter unvarnished. The building has been erected from the plans and under the supervision of Mr. E. W. Lockwood, architect, Huddersfield; and the following were the contractors:—Mason, Mr. Robert Turner, Holmfirth; joiners, Messrs. J. & J. Shaw, Holmfirth; slaters, Messrs. Pickles Bros., Huddersfield; plasterer, Mr. T. B. Tunnicliffe, Huddersfield; plumber, Mr. J. Kenyon, Holmfirth; hot water, Mr. Rayner, Holmfirth; painters, Messrs. Spence & Co., Honley.

WESLEYAN CHAPEL, THORPE HESLEY.—The foundation-stones of a new Wesleyan Methodist chapel were laid at Thorpe Hesley, on the 13th inst. The new building will comprise a church to accommodate 350, an organ-chamber, end gallery, approached from the front by means of a staircase, and main entrance. There is to be one large vestry. The front and staircase of the church will be faced with sandstock bricks, with local stone dressings. The roof will be partially open, and the windows will be glazed with ornamental leaded lights. The building will be heated on the low-pressure system. The contractor is Mr. J. Cooper, of Rotherham. The design is that of Mr. A. E. Lambert, of Nottingham, whose work was accepted in open competition. The cost will be about 2,000*l*.

METHODIST CHAPEL, HULL.—The erection of a new chapel for the Methodist New Connexion body at Hull has just been commenced. The building will face the Boulevard, and is from designs by Mr. W. H. Bingley, of Whitefriargate. The contractor is Mr. Sanderson, of Hull, and the cost, exclusive of land, will be 2,505*l*.

WESLEYAN METHODIST CHAPEL, SOUTH ELLESMERE.—The foundation-stones were laid recently of a new Wesleyan Methodist Chapel, which is being built at South Ellesmere. The building is being erected in King-street, and it will accommodate about 250 persons. The cost, including the land, will be about 1,000*l*. The church is designed after the Gothic style, the architects being Messrs. J. H. Davies & Sons, Chester.

SCHOOL ENLARGEMENT, MIDDLESBROUGH.—The Middlesbrough High School has recently been enlarged by the addition of a west wing. The new wing provides accommodation for 240 pupils, and, with the exception of the studio and music rooms on the second floor of the south wing, is arranged on two floors. The principal entrance is at the King Edward's-road front of the buildings, and another entrance is provided into the playground at the Clarendon-road front of the school. On the ground floor are porch and hall at the north and south end of the school with staircase adjacent giving access to the upper floor. Adjoining the main entrance a waiting-room and head mistress's rooms are provided. The main feature of the ground floor is the assembly-hall, 60 ft. by 31 ft. 3 in., with a platform at one end. In addition, on this floor, are four classrooms, cloak-rooms, and lavatories for the pupils. The first floor has six classrooms, students'-room, and assistant mistress's-room, store-rooms, and lavatories, a corridor giving access to the classrooms. The second floor contains studio, 33 ft. by 24 ft., and two music classrooms. Mistresses' cloak-rooms and store-room are provided on

Mezzanine floor. There are also cellars for heating apparatus, coal storage, etc. Laboratory accommodation is provided in a separate building on the southern extremity of the site, with a frontage to Clarendon-road, and includes laboratory, fitted up for physics and chemistry, lecture theatre, dark-room, and store. The staircase and the whole of the first floor are of fireproof construction. In addition to windows, which are provided with beads to allow of air inlets at meting rail level, and hoppers to upper sashes, air-outlet flues are provided from the ground-floor rooms, and Cousland & Mackay's concealed roof ventilators are used for extracting purposes to rooms on upper floors. Each room is provided with a fireplace, in which is fitted Shoreland's Ventilating Stove. The principal heating is by low-pressure hot-water. The interior woodwork (with the exception of the main entrance porch, which is in oak) has been carried out in pitch-pine, and stained green. The floors are laid with maple blocks. Electric light is fitted throughout the buildings. The elevations are faced with red pressed bricks, and have Dunhouse stone dressings, and the roof is covered with dark Lancashire slates. The total cost of the work was about 10,000*l*. The principal contractor was Mr. Geo. M. Radge, Normanby, whilst the following were the subcontractors:—Joinering, Messrs. W. A. King & Son, Ltd., North Ormesby; plumbing, Mr. T. B. Watson, Stockton-on-Tees; slating, Mr. W. B. Robinson; painting, Messrs. W. L. Taylor & Son; plastering, Messrs. Smiles & Dawson; carving, Mr. A. J. Arrowsmith, London; electric lighting and heating, Messrs. Baker Bros.; asphalting, Mr. David Mullen; hardware, Messrs. N. F. Ramsey & Bros., Newcastle-on-Tyne; constructional ironwork, Messrs. Dorman, Long, & Co. Mr. J. G. Duckworth has acted as clerk of works, and Mr. Cecil E. Lugard as electrical engineer. The whole of the work has been carried out from the designs of Mr. T. A. Lofthouse, of the firm of Messrs. R. Lofthouse & Sons, architects, Middlesbrough.

PROPOSED ART SCHOOL, EDINBURGH.—A meeting of the sub-committee of the Provisional Committee, which has under consideration the proposed new art school for Edinburgh, was held on the 12th inst., in the City-chambers. Lord Provost Sir Robert Cranston presided, and among those present were Mr. Pittendrigh Macgillivray, R.S.A.; Mr. Kinross, A.R.S.A.; and Mr. Morham, City Architect. The principal object of the meeting was the consideration of a set of plans for the new school, prepared by Mr. Macgillivray and Mr. Morham, with the view of embodying, as far as possible, various suggestions made by the members of Committee. The plans, it is understood, were found to be satisfactory, though they show that, if adopted, a larger area than that originally regarded as likely to be sufficient will be required. The meeting was adjourned for a week, by which time the Committee hope to have before them such information as will satisfy them as to the minimum accommodation which should be provided.

SYNAGOGUE, HIGHER BROUGHTON, MANCHESTER.—The new synagogue, about to be erected by the Higher Broughton congregation, will occupy the garden ground at the corner of Broughton-road and Duncan-street. It will have accommodation for about 400 persons. The main entrance, from Duncan-street, will have the main staircase (to the gallery above set apart for the ladies of the congregation) enclosed in an octagonal tower. The ark, reading platform, and pulpit will be arranged at the eastern end of the building, with the choir behind. A dome in ferro-concrete will surmount the octagonal tower, and the main vestibule will be arcaded. The designs for the building have been made by Mr. Delissa Joseph, architect, of London.

PROPOSED CRICKET PAVILION, THIRSK.—The Thirsk Cricket Club Commiteee have under consideration the erection of a new pavilion on their ground. Mr. Stokes, architect, has been appointed to prepare sketch plans and give estimates of the proposed work.

POLICE-STATION, LONGTON.—The new police-station, at Longton, has been erected by Messrs. Tomkinson & Betteley, at a cost of about 7,000*l*. The designs were by Mr. W. H. Cheadle, County Surveyor, and Mr. A. R. Wood, Tunstall. The frontage to Sutherland-road is of red brick, with light buff terra-cotta facings. Excavations were in some places of considerable depth, and a foundation of concrete was placed over the clay surface. A dwelling-house for the superintendent forms the southerly end of the block, and the other accommodation of the buildings consists of a suite of offices, cells, and exercise yard, living and sleeping quarters for the single constables, the necessary outbuildings, and a large open area as a drill-ground. Mr. Kearton, Wolstanton, has been clerk of the works. Mr. Durose, Tunstall, fixed the iron palisading at the front, and executed the ornamental ironwork; Messrs. Blackburn & Starling, Hanley, installed the electric bells, tubes, etc.; and Mr. Trusswell, of Newcastle, fixed the heating apparatus.

PROPOSED PIER, FLEETWOOD.—It is proposed to erect a pier at Fleetwood. The situation chosen for the new structure by the promoters of the scheme is opposite Balmoral-terrace. The pier is to be 700 ft. long, inclusive of a timber jetty 200 ft. long and 15 ft. wide, which will have its terminus in water at all states of the tide. The entire structure will be on piles, with screw piles where necessary, the girders being of toughened steel, with Jarrow wood planking and ornamental seating and railing. The first length of the pier, including the pavilion, will be 247 ft., varying in width from 120 ft. to 25 ft. The second length of 253 ft. will have a width of 25 ft. throughout, and the third section is the timber jetty. The elevation of the jetty will be 12 ft. vertically below the main deck of the pier proper, which will be on a level with the existing promenade. The entrance to the pier will be located 24 ft. away from the line of the promenade, and will consist of pay-boxes on two sides, with a main covered way of 15 ft. in width, over which will be store-rooms for the use of the pier generally. On the left of the approach the manager's office will be arranged, and on the right a series of cloak-rooms; while outside these two buildings, on either side, will be exit gates, making a total width over offices and main entrance of 52 ft. The pavilion has been designed to be situated within 68 ft. of the promenade. It will have seating accommodation in the body of the hall for 1,100, and in the two side galleries for 300. The whole will be constructed of timber, with glass, lead, and zinc roof, with closing verandas. Arrangements will be made for electric and gas lighting. Mr. J. E. Stafford, C.E., is the engineer of the scheme.

THEATRE, MANSFIELD.—The new Grand Theatre at Mansfield has just been opened. Externally, the building is of brick, with stone dressings. The stage is 40 ft. long by 65 ft. wide, the height being 50 ft. Four dressing-rooms, the width of the stage, are provided, and there are extra rooms underneath. The building will accommodate about 1,240. The stalls will take 120 persons, the dress circle 120, the upper circle 400, and the gallery 600. Each section of the house has two exits, and there are also separate entrances. The lighting is by electricity, and the heating by hot-water radiators. The theatre was built by Mr. A. F. Houfton, of Mansfield, from the designs of Mr. T. V. Woodhouse, architect, of Nottingham.

Sanitary and Engineering News.

LEEDS WATER SUPPLY.—It is announced that the City Council of Leeds have decided to proceed with an extensive scheme, based upon reports framed by Mr. C. G. Henzell, the City Water Engineer, jointly with Mr. Rofe, the consulting engineer, and by Messrs. H. Rofe & Son, of Westminster. The modified project involves a departure from the plans as originally adopted under the Act of 1901 for a reservoir at Colsterdale, in the Burn valley, to extend over 107 acres, with a capacity of 1.852 million gallons. It has been discovered that the site selected does not afford a good foundation for the retaining wall; another site has therefore been chosen, higher up the valley, for a reservoir to be embanked with a dam 15¼ chains long across the river Burn, for which, and for accessory works, fresh Parliamentary powers will be sought. When the Carlesmoor and Laverton reservoirs in the Laver valley and the Leighton reservoir in the Burn valley are also completed, the total storage will amount to nearly 2,265 million gallons, and the cost of the entire undertaking, after allowance made for the large sums already expended, is estimated at some two millions sterling.

ELECTRICAL LIGHTING AND ENERGY, MARYLEBONE.—The Borough Council have resolved to charge consumers within the borough limits for a supply at 240 or 480 volts (*a*) for ordinary lighting purposes, 8d. per unit for a quantity equivalent to 500 hours' use of the maximum demand made for energy in each year, and 1d. per unit for all energy consumed in excess of that quantity during the said year; (*b*) through special circuits and meters for all purposes other than lighting, 2d. per unit for a quantity equivalent to 125 hours' use of the maximum demand made in each quarter, and 1d. per unit for all energy consumed in excess of that quantity during the said quarter; and to charge 2d. per unit consumed for current supplied by separate circuits and meters to basements not used for dwelling purposes. The meter rents will be at the rate of 10*s.* per annum for each fifty 8 candle-power (32 watt) lamps installed, or the equivalent in kilowatts or parts thereof, with additional rentals at those rates for separate meters required for special currents. A discount of 25 per cent. will be allowed, under conditions, on each quarter's account exceeding 50*l*., calculated upon the rates severally specified. The Council have, moreover, resolved to substitute arc lamps for the incandescent mantles in some of the lamps of the principal streets; the new installation will consist of five single arc lamps, six central arc lamps, and thirty-five arc lamp columns, each bearing two lamps, all the lamps being after the "flame" arc kind made by the Union Electric Company. The charge of 8d. per Board of Trade unit is an advance beyond that of 6d., or less, which was formerly made by the Metropolitan Company in Marylebone.

LOUGHBOROUGH WATERWORKS. — The new waterworks, for which Mr. Hodson was the engineer, were opened on September 12. The reservoirs at Black Brook, in Charnwood Forest, are equal to a supply for 60,000 persons, and the Town Council will sell the surplus (enough for 30,000) to Leicester, pending the completion, in about seven years' time, of the Derwent Valley supply system for that borough. The heavy cost, some 120,000*l*., of the Loughborough undertaking is due to difficulties presented by unexpected faults of the rock formation.

HARBOUR AND DOCK EXTENSIONS ON THE CLYDE AND THE FORTH.—The new works which are being carried out by the Clyde Navigation Trustees comprise a widening of the channel and harbour at Renfrew, with workshops and slips for the repair of dredging plant now being used at Blythswood and between Newshot Island and the River Cart; the removal of Pointhouse Wharf, and new timber wharves and cattle lairages at Merklands; and basins and quays at Yorkhill. The newly-completed wharf beyond Shieldhall, nearly 1,700 ft. long, is to be extended eastwards by about 430 ft. At Clydebank Dock are being constructed a culvert to divert Yoker Burn, a road by the side of the Lanarkshire and Dumbartonshire Railway, and dock sidings to meet a branch line to be laid by the North British and Caledonian Railway Companies. The walls of the dock will extend over a length of nearly 6,650 ft., and it is anticipated that the quay walls will be finished before the close of next year. The Harbour Commissioners for the Forth have granted to a syndicate a lease of 8 acres on the west side of the harbour at Burntisland for the construction of a dry dock and ship-repairing workshops, to serve the ports on the south coast of Fife.

MANCHESTER SHIP CANAL.—Under the directions of Mr. W. H. Hunter, the Company's chief engineer, steps have been taken to keep in the tidal water, concurrently with a deepening of the canal water by 2 ft. This has been effected by the laying of a 2-pipe siphon, 180 ft. long, across the bed of the canal at Frodsham Marsh, for conveying the Hoolpool Gutter stream, the Frodsham sewage, and the water from the low-lying lands, around which will thereby become more subject to floods. Each length of pipe is 6 ft. long, and has an inner diameter of 3 ft. 6 in.; the lengths are bound together and coated with cement 5 in. thick, enveloped with steel wire-netting. The siphon was towed down to its position from Big Field, Norton, eight miles distant, having its ends sealed, and being supported by three pontoons.

SUSPENSION BRIDGE, NOTTINGHAM.—The new footbridge over the River Trent between Trent Bridge and Wilford Bridge was recently opened. The bridge has a span of 225 ft. between centres of abutments, and is 12 ft. wide. Below the footway are two steel water mains, each 14 in. internal diameter, conveying water to and from the new reservoir on the top of Wilford Hill. The four cables, each constructed of 259 wires, are manufactured of the best plough steel. The ends of the cables on either side of the river are anchored to steel girders with adjustment arrangements, the girders being weighted by blocks of concrete. The cables pass over steel rockers on the tops of the abutments, these rockers being attached to steel girder frames built in the stone abutments. The ultimate strength of each cable is about 280 tons. The cables support, by means of fifty-eight suspension rods, the whole of the weight of the cross-girders, pipes, footway, etc. Two lines of 12 in. diameter gas pipes have also been laid across the bridge for use at any future time, and there is also provision for electric cables. The structure was designed by Mr. W. B. Bryan and Mr. F. B. Lewis, the City Architect, and constructed under the supervision of Mr. F. W.

Davies, the Water Engineer for the City. The contract for the foundations, abutments, and approaches was let to Mr. J. G. Thomas, of Lenton-boulevard, Nottingham, and the steel-work to Messrs. Handyside & Co., of Derby.

NEW WATERWORKS, BUNTINGFORD.—The well for the new waterworks has been completed by Mr. G. Hughes, of Westminster. It is 134 ft. deep, and is capable of yielding 10,000 gallons of water per hour. The cost of this first contract was 500*l*. For constructing the reservoir and laying some three miles of mains the District Council invited tenders, and some nineteen were received. That of Messrs. Grounds & Newton, of South Tottenham, was accepted for 3,167*l*. The work has to be completed within eight months. Mr. J. Chadwick, of Bletchley, is the engineer, and to him was due the scheme for the Hadham Waterworks.

THE LONDON COUNTY COUNCIL'S DRAINAGE BY-LAWS.—The Public Health Committee of St. Pancras Borough Council, in a Report issued on Monday, stated that they had had under consideration a communication from the London County Council, in reply to a letter from the Committee, in which it was pointed out, that, under No. 8 (4) of the drainage by-laws made by the County Council under sect. 202 of the Metropolis Management Act, 1855, sanitary inspectors were obliged to compel builders to put 4-in. ventilating pipes to 3½-in. soil pipes and 3-in. drain pipes allowed under by-laws Nos. 11 (2), 4 (9 and 10). The County Council, in their reply, called attention to the provision in No. 8 (6) of the by-laws, that, where the drain to be ventilated is not more than 4 in. in diameter a soil pipe or waste pipe containing excremental filth, although only 3½ in. in diameter, may be used as a ventilating pipe subject to certain conditions; and, further, that, in regard to the ventilation of drain pipes, the drain for which ventilation is primarily required is a drain containing sewage, which is required by by-law No. 4 to have an internal diameter of not less than 4 in. The Council stated that, under these circumstances, they had decided to take no action in the matter. The Committee had received the following report from their Medical Officer of Health (Dr. J. F. Sykes) on the subject:—

"Builders still continue to complain that they are allowed to put up a 3½-in. soil pipe and a 3½-in. vent pipe to ventilate a 4-in. drain, but that if they ventilate a 4-in. drain not having a soil pipe, but a branch water-closet drain on the same level, they are compelled to make a branch 4 in. diameter and the vent pipe 4 in. diameter. In other words, if the vertical vent pipe is the continuation of a 4-in. horizontal drain, it must be 4 in. in diameter; but if to this vertical vent pipe a water-closet is connected, it becomes a soil pipe, and may, together with the soil pipe, be reduced to 3½ in. in diameter. A soil pipe is a direct continuation and part of a drain, that portion which is horizontal being called drain, and that which is vertical being called soil pipe, so that a soil pipe is a vertical drain, and should be subject to similar provisions. The anomaly was typically apparent in the case of the teachers' house at All Saints' School, Pancras-street (see Plan No. 10,270), where your committee declined to take any action against the builder for putting up a 3½-in. ventilating pipe to the drain because the water-closet was on the basement level instead of the first floor. The continual irritation and annoyance caused by this anomaly is not experienced by the London County Council, but by the Borough Council, which is the executive authority, and I feel sure that the London County Council would rectify the wrong upon the representations of the sufferers if sufficient pressure were brought to bear. A great amount of confusion and complaining would be avoided if a minimum diameter of 4 in. were adopted for soil pipes in by-law 11, paragraphs 5 and 2, or if a minimum diameter of 3½ in. were adopted for drains in by-law 4, paragraphs 3, 9, and 10, and for vent pipes in by-laws 8, paragraph 4. One of these alternatives should be adopted."

A copy of the foregoing report of the medical officer is to be forwarded to the London County Council.

ELECTRICAL EXHIBITION, SHEFFIELD.—An exhibition of electrical machinery and appliances is being arranged at the Corn Exchange, Sheffield. It will be opened by the Lord Mayor at 3 p.m. on the 27th inst., and will remain open to the public daily from noon to 10 p.m. until October 20. A number of exhibits of peculiar interest to the local metallurgical and engineering industries have been secured, as well as a display of domestic and public lighting apparatus.

Stained Glass & Decoration.

MEMORIAL WINDOW, ATHELSTANEFORD, N.B.—A memorial window to the late Lady Kinloch, of Gilmerton, has been placed in Athelstaneford Parish Church. The window is the work of Mr. E. C. Kempe, London, and represents the Presentation of the Infant Christ in the Temple.

EMMANUEL CHURCH, SOUTHPORT.—Messrs. Percy Bacon & Bros. have just added some more stained-glass windows to this church, having executed six clearstory to light windows; the first two represepting Angels; the second two SS. Peter, James, John, and Andrew; the third two Isaiah, Jeremiah, Ezekiel, and Daniel.

Foreign.

GERMANY.—Professor Theodor Fischer, of Munich, who has lately been appointed to the Chair of Architecture in Stuttgart University, has influenced modern architecture in Munich to an unusual degree, and stamped it with his personality. His style, although individual, harks back to the simple work characteristic of the early local art. It is too devoid of ornament to appeal to the lay mind, but it is just this simplicity and the masterly way in which he handles it that makes him rank among the greatest artists of his country. In his Fangelsbach School, Stuttgart, opened last May, Fischer has developed the whole scheme of his artistic style, and shown how effect may be produced by a broad and simple treatment. ——The question is ever brought up anew as to the material used for roofing our early mediæval monuments. It is, however, incontestably proved by local evidence that a portion of Wetzlar Cathedral was roofed with perfectly-made tiles (16½ in. by 7½ in.) in the second half of the XIIth century, though fifty years later these were replaced by slate. Although in Wetzlar slate completely superseded tile, in the neighbouring Hessian provinces both materials were used simultaneously. ——Plans have been drawn out for enlarging the harbour of Harburg, which town lies 10 kms. south of Hamburg; 184 hectares have been added to the existing harbour, and upon this tract of land four basins will be constructed having a depth of 9·8 m. These will be in direct communication with the south Elbe, and will greatly facilitate traffic, for up till now large ships for Harburg have been obliged to berth at Altona or at Hamburg, while barges carried their cargoes to and from Harburg. The cost of carrying out the proposed additions will amount to 7,500,000 marks, plus the cost of the land, 3,800,000 marks.——In a paper read before the Institute of Architects and Engineers of Munich, Dr. Bredt pleads for a modern style which shall illustrate the requirements of our times. He backs his arguments by the statement that our forefathers erected their modern buildings side by side with the ancient work without destroying artistic effect, and we should also design modern buildings which need not be out of harmony with their ancient surroundings.

SWITZERLAND.—An electric cog-railway is to be laid from Bregenz to the summit of the Pfänder. The line will be 2·9 km. in length, and will climb a height of 575 m. The cost is estimated at 1,100,000 francs.——The Empress Eugénie has presented to the canton Thurgau the charming XVIIth century Castle of Arenaberg, situated on the Lake of Constance, where Napoleon III. lived as Prince Napoleon. The castle contains much good furniture and other works of art, collected during two centuries, and now rearranged by Herr Pietri, the Empress's representative.

ITALY.—The defacement of the Apponale Clock Tower, Riva, is to be feared. This tower, dating from the XIIth and XVIth centuries, is a characteristic feature of the town, and the present intention is to remove the attractive barocco tiled roof, and replace it with a "correct ornate Gothic" spire.

SOUTH AFRICA.—Notwithstanding the general depression which still obtains in Johannesburg, there is stated to be a fair amount of work in the building trade along the several routes of the new electric trams in the East Rand.——At Clifton, the foundation-stone of the new parish hall has been laid. The building is being erected at the junction of Loveday and Siemert streets by Mr. F. W. Parkin, the architect being Mr. J. Moodie.——Sir Hamilton Goold-Adams, the Lieut.-Governor, recently laid the foundation-stone of the new Grey College and University, near Bloemfontein, towards the erection of which the Government have voted 125,000*l*., the site being a gift of the Town Council.——The annual Report of the Incorporated Law Society, presented at the meting in Cape Town, stated that the idea of erecting suitable law courts in Cape Town had made some progress. "A design has been selected out of the many submitted, and the specification for the building has been, by the courtesy of the Attorney-General, shown to your council for their suggestions. In view of the very inadequate provision for the conduct of legal work at present, the urgency for the completion of these buildings is very great."

Miscellaneous.

PROFESSIONAL AND BUSINESS ANNOUNCEMENTS.—Messrs. R. J. Nicholson & Co., electrical and mechanical engineers, have removed from Bank-buildings, Cannon-street, Manchester, to Macdonald's-lane, Corporation-street, Manchester.——Messrs. Jay, Broll, & Co., 31, Old Queen-street, Westminster, have been appointed London managers to the Asbestos Paint Company, of Birmingham.——Messrs. T. T. Gething & Co., quarry owners (Warwick-road, Kensington), have purchased from the Trustees of the late T. P. Lilly the business (including lease, stock, and plant) of the well-known Chilmark quarries.

CURIOUS BRACKETS.—There is a very quaint bracket supporting one of the ribs of the north aisle vaulting at Kiedrich, two miles from Ettoille-am-Rhein, the beautiful pilgrimage resort between Rüdesheim and Mainz. It represents, when viewed in one position, the head of St. Thomas Aquinas; but in another position it shows an unmistakable calf's head, obviously intended to render symbolically the "Dumb Ox of the Sorbonne," which nick-name he earned at that college. The enormous ear he is given does duty also as snout for the calf's head. Close to is another bracket, representing a slender female figure, apparently, down to the waist, with the arms akimbo, and holding a book; but, curious as it is, the one of St. Thomas is the only one to which the attention of visitors is called. The church, which is galleried, has a beautiful rich vaulting, with many coats of arms, especially in the choir, and a fine XIVth century "Sacrament House," wonderful altars, and richly-carved pews, all Gothic. The whole fabric, indeed, is worthy of the closest study; but the quaint St. Thomas there will haunt one, even if nothing else there does. In the adjacent St. Michael's Chapel in the churchyard is a superb candelabrum, with a double statue of the Madonna, back to back, and the east end of the chapel is rectangular, with an apse let in, supported outside with rich mouldings on a shaft. A crypt is beneath.

A NEW FORM OF STEEL PILE.—The steel piles invented by Mr. William Clarke, of Ayr, consist of specially rolled sections which can be made in any length up to 70 ft., and from 1 ft. to 3 ft. wide. Two types of piles, of channel and I-section respectively, are contemplated by the patentee, one intended for permanent and the other for temporary work. In either case the adjoining piles are connected by a dovetailed joint, one side of each section containing a groove and the other a corresponding tongue which does not fill up the entire space and leaves room for suitable packing material. For permanent work the channel piles can be driven in the ordinary manner. In the construction of a dock, breakwater, pier, or similar structure, the procedure recommended is to drive the piles to the form and in the line of the structure and to within 2 ft. 6 in. of the top level so that the work may be finished with a granite coping of that thickness. After the piles have been driven, the open space within the dovetailed joint is to be filled up with rust cement to make the work watertight. By bracing and shoring the piles from behind, the water may be pumped out, thus leaving the area within perfectly dry for the workmen, and, after the foundations have been taken down to the depth required, the interior may be filled up to the desired level with concrete. The bracing and the piles remain permanently in their places forming a wall with a steel face. The I-section piles for temporary cofferdams are applied in a similar manner, and the piles can be witddrawn when the work is finished for use elsewhere. The procedure in this case is to surround the proposed work, at a distance of 3 ft. or 4 ft., with one row of piles and to fill up the space in the joints with oakum or other material. The enclosed area will then be watertight and excavation can be commenced at once. The idea represented by the piles here mentioned is realised in a far better way by previously patented forms of steel sheet-piling made of standard sections which are readily obtainable and can be used for structural work if required after having served their purpose as temporary piling. Apart from the objections that apply to all specially rolled sections, the form of joint adopted for the Clarke piles is one that cannot be completely finished in the rolling mill so as to insure uniform contact, and if, as suggested by the drawing we have received, the grooves and tongues have to be machined, the extra work thereby entailed must mean a considerable addition to the cost.

MANDEVILLE MEMORIAL, CORK.—The monument to John Mandeville and to the three men, Lonergan, Shinnick, and Casey, was unveiled by Mr. William O'Brien, M.P., on the 8th inst. The memorial consists of a figure of Mandeville in bronze on a pedestal of limestone, on the panels of which are engraved the names of Lonergan, Shinnick, and Casey. The sculptor is Mr. Doyle Jones.

SCOTTISH BUILDING TRADES FEDERATION.—The twelfth annual general meeting of the Scottish Building Trades Federation was held on the 7th inst. in the Building Trades Exchange, 26, George-street, Edinburgh. Mr. Patrick Knox, president, occupied the chair. Reports on the state of trade by the different branches indicated that the building trade was in a very depressed condition. Mr. Patrick Knox was re-elected president, and Mr. William Nicoll, Dundee, vice-president. It was agreed that the headquarters of the Federation should be permanently fixed in Edinburgh, and that Mr. James Cameron, solicitor, Edinburgh, should act as permanent secretary and treasurer. It was arranged that the half-yearly meeting of the executive should be held in Edinburgh in April next year, and that the annual general meeting should be held in Dundee next September. In the evening the members dined at the Royal Hotel, under the presidency of Mr. Patrick Knox. Mr. William Nicoll, Dundee, and Mr. James Leslie, Aberdeen, acted as croupiers. Mr. Thomas Hume, proposing "The Scottish Building Trades Federation," spoke of the value of the Federation to the trade. Not a day passed without their reading something about the unions of the workmen, which more than ever were before the public, largely because of their now having so many representatives in Parliament. He hoped the Federation would become so strong that they too would be able to send members to Parliament to look after their interests. The President, in the course of his reply, congratulated the delegates on the spirit which had pervaded the meeting held that day. Mr. William M'Donald, Inverness, proposed "The Edinburgh, Leith, and District Building Trades Association," and Mr. R. Lamb replied.

NORTHERN POLYTECHNIC INSTITUTE.—The work of the architectural and building section is now organised in four sections, viz.:—(1) The architectural and building day school; (2) the building day trade school; (3) manual training courses; (4) evening classes. The architectural and building day school for young architects, builders, and surveyors, is provided with a third-year course of day study to be taken by pupils if desired. A new special two years' evening continuation course for advanced students is also provided as an alternative to the third-year day course. The second-year course is in part differentiated so that pupils who intend to become builders or estate surveyors may have opportunities of taking special classes in correspondence and book-keeping, and in office routine and business methods. The day trade school is an entirely new departure, and has been established as the result of a conference of building employers and others held at the Polytechnic last winter. The object of this school is to partially replace the apprenticeship system. For the purposes of this school, new building extensions are contemplated, and will, it is hoped, be available about the end of the year. Another feature to be introduced this year is the improved system under which building construction will be taught. Hitherto the almost universal method of instruction in this subject has consisted of lectures on a comprehensive series of building details, followed by production of drawings of detached items of construction. In spite of the teachers' best efforts the drawings too often remained mere abstractions to the student, while his concrete ideas of building construction were diffuse, incomplete, and of meagre use in the correlation necessary for the simplest design. The system of comprehensive, but quite disjointed, analysis will be replaced by synthetic method. The study of details will be correlated, leading up to a single but complete and unified design of a building. Large scale take-to-pieces models of complete buildings have been provided for this purpose.

A PICTURE ASCRIBED TO RUBENS.—It is stated that a picture, which has just been discovered in a house at Austruweel, near Antwerp, is pronounced by experts to be an example of Rubens. The painting is on canvas, 5 ft. by 4 ft., and was formerly in the parish church, having been taken thither from Antwerp eighty years ago. It delineates the Assumption of the Virgin, with apostles and holy women opening her tomb as she ascends to heaven.

BERKELEY CHAPEL, MAYFAIR.—The site of this chapel, at the corner of Charles and John streets, has been taken for the erection of new buildings after plans and designs by Mr. R. G. Hammond. The chapel, built after the "Georgian" style, contained sittings for 1,100 persons; a memorial window to the late Duke of Clarence was set up there in May, 1894.

PROTECTION OF WOODEN PILES IN WATER.—The *United States Railway Gazette* contains a description of an appliance which, the inventors assert, will effectively shield wooden piles from attacks by the teredo worm. The pile is enveloped at the surface of the water in a pipe made of cement, and divided lengthwise into two halves keyed together with a scarf joint. The pipe sections are lowered around the pile to the water bed, and then, having settled to the extent of a few inches, are filled with a core of sand around the pile they enclose.

SCHOOL OF ART WOOD-CARVING.—The School of Art Wood-carving, South Kensington, which now occupies rooms on the top floor of the new building of the Royal School of Art Needlework in Exhibition-road, has been reopened after the usual summer vacation, and we are requested to state that some of the free studentships maintained by means of funds granted to the school by the London County Council are vacant. The day classes of the school are held from 10 to 1 and 2 to 5 on five days of the week, and from 10 to 1 on Saturdays. The evening class meets on three evenings a week, and on Saturday afternoons. Forms of application for free studentships and any further particulars relating to the school may be obtained from the manager.

SCHOOL ARCHITECTS AND PLANS.—At the meeting of the West Ham Education Committee on Monday, the Works Sub-Committee reported having been informed by the architect (Mr. Jacques) that some difficulty had arisen with the auditor on the interpretation of the agreement entered into by the late School Board and himself on his appointment with reference to payment for lithography of specifications, in consequence of the following clause:—"For which commission the architect undertakes to prepare and supply all necessary plans, drawings, and specifications, and copies thereof." The architect had always provided at his own expense the necessary plans and specifications for carrying out the work, but the expense of providing an additional number of copies of the specifications for the use of contractors desirous of tendering for works had always been borne by the late School Board. In some instances, the cost of lithographed specifications required for school cleansing purposes exceeded the entire fees received by the architect as commission for the work. The Committee recommended, in order to make the matter perfectly clear, that the agreement entered into with Mr. Jacques be endorsed so as to definitely show that he is responsible only for preparing the necessary plans and specifications required for the execution of works, and not for lithographed copies supplied to contractors to enable them to tender, which, when the architect considers them necessary, shall, as heretofore, be paid for by the Education Committee. The report was adopted.

Legal.

EXETER BUILDING DISPUTE.

THE case of Smith *v.* Stuckey's Banking Company, Ltd., and others, came before Mr. Justice Sutton, sitting as Vacation judge, on the 12th inst., on an application by plaintiff for an interim injunction to restrain the defendant Company and Messrs Luscombe & Sons, Ltd., a firm of builders, until the trial from further pulling off the roof of No. 253, High-street, Exeter. The plaintiff also asked that the defendants should be ordered to restore the premises into the state into which they formerly were.

Counsel, in support of the application, said the plaintiff was in possession of the premises, No. 253, High-street, Exeter, as a monthly tenant under an agreement dated July 20, 1903, he carrying on there the business of a hairdresser. The landlord sold the premises to the defendant Banking Company early in the present year, and it was in the interest of the Bank to get rid of the plaintiff as the tenant as soon as possible.

Mr. Bramwell Davis, K.C., said he appeared for the defendants, and his point was that the Bank gave the plantiff notice on April 21 to determine his tenancy on May 21, and that, as the plaintiff had not gone out of possession, he must be treated as a trespasser. His case, therefore, was that his lordship would not grant the injunction asked for.

Counsel for the plaintiff said he admitted the notice in question to terminate the tenancy was given, but his case was that that that notice had been waived, and that an entirely new agreement was entered into which set aside the old agreement.

After considerable discussion, his lordship intimated that, in his opinion, the plaintiff's remedy, if any, was damages. He refused to grant the injunction, on the Bank undertaking not to take any steps to turn the plaintiff out of possession for seven days.

NEWINGTON SEWAGE DISPUTE.

THE case of the London General Omnibus Company, Ltd., *v.* the Tilbury Contracting and Dredging Company (1906), Ltd., came before Mr. Justice Sutton, in the Vacation Court, on the 12th inst., on a motion by the plaintiff Company for an interim injunction to restrain the defendants until the trial or further order from making a certain sewer, injuring the plaintiffs' premises at Newington.

Mr. Bramwell Davis, K.C., in support of the motion, said that the defendants had filed certain affidavits, and from these it appeared that the sewer was practically completed. All the excavations in connexion with the sewer were over, and the sewer would be completed in a few days. The only direction he asked for was that no order should be made on the present motion, and that the costs should be made costs in the action. Defendants said that in what they did they were acting under the direction of the London County Council. The plaintiffs had not made the London County Council defendants to the action, and he, therefore, asked for leave to amend the writ by adding the Council as defendants in case it was found that it was essential that that course should be pursued.

Mr. Mulligan, K.C., on behalf of the defendants, assented to the application of Mr. Bramwell Davis. He said that the defendant Company was an important one, and throughout the work in question defendants had acted under the supervision of the London County Council, and it was on the evidence that the defendants had carried out the work with the utmost care, and that every possible precaution was taken to prevent damage.

Mr. Bramwell Davis: You must not say that, because that will have to be determined at the trial of the action.

Mr. Mulligan said that the defendants had finished all the excavations in the front of the plaintiffs' land, and plaintiffs had therefore no further cause of complaint. He acceded to the application of his learned friend that there should be no order on the motion except that the costs should be made costs in the action.

Patents of the Week.

APPLICATIONS PUBLISHED.*

18,000 of 1905. R. MARSHALL: *Attachment for Fire Grates.*

This relates to an attachment for fire grates, and consists of a single piece of sheet metal provided with ledges adapted to carry smoothing irons during heating, and convertable into a trivet or cooking tray, acting as a fuel economiser and guard when arranged to close in front of the grate.

23,781 of 1905.—G. T. MOORE: *Elevator for Window Sashes and the like.*

This relates to a window elevator, consisting of the combination of a rotatably-mounted toothed quadrant, a handle for rotating said quadrant, means associated with said handle for enabling it and the quadrant to be held in varying positions, a pinion engaging with said quadrant and adapted to be rotated thereby, a spindle upon which said pinion is keyed, a pulley keyed upon said spindle, and a flexible connexion between the window sash and the said pulley operating to elevate the window sash when the pulley revolves in one direction.

24,636 of 1905.—G. O. H. KLOPP: *Cocks or Taps.*

This consists in the combination with a cock or tap of a coiled spring, whereby the ball-valve will be firmly held against the seating in the outlet chamber, except when positively forced therefrom, notwithstanding diminution of the pressure of the water supply or the total cutting off of the supply.

24,787 of 1905.—H. RUDDER and J. C. ROUSE: *Hinges for Doors and Gates.*

This relates to hinges for doors and gates, and consists in the provision of an extension of the strap or the like, having U-shaped notches, with a depending pin and nut acting in conjunction with a post-plate with horizontal seating having radial slots therein and projections, the pin of the extension working in the radial slots, and the notches of the extension engaging the projections on the seating of the post-plate.

26,462 of 1905.—J. FABRITIUS: *Building and like Structures.*

This relates to a composite structure for building purposes, comprising one or more courses of bricks provided with outside irons, connecting parts of any desired cross-section, and a wrapping or winding of wire for binding the whole together, the whole construction being finally covered with cement.

* All these applications are in the stage in which opposition to the grant of Patents upon them can be made.

PATENTS,—*Continued on page* 359.

List of Competitions, Contracts, etc.

For some Contracts still open, but not included in this List, see previous issues. Those with an asterisk (*) are advertised in this Number: Competitions, —; Contracts, iv. vi. viii. x.; Public Appointments, —; Auction Sales, xxviii.

Certain conditions, beyond those given in the following information, are imposed in some cases, such as: the advertisers do not bind themselves to accept the lowest or any tender; that a fair wages clause shall be observed; that no allowance will be made for tenders; and that deposits are returned on receipt of a bonâ-fide tender unless stated to the contrary.

Contracts.

BUILDING.

SEPTEMBER 24.—**Altwen.**—TWO SHOPS.—Altwen and Pontardawe Co-operative Society, Ltd., invite tenders for the erection of two shops at Altwen. Plans, etc., and all particulars can be obtained at the offices of the architect, Mr. Charles S. Thomas, Herbert-street, Pontardawe, or Wind-street, Swansea. Tenders to be sent in to the Secretary, Mr. Walters, Altwen, near Pontardawe, on or before September 24.

SEPTEMBER 24.—**Archiestown.**—CHURCH REPAIRS, ETC.—Tenders are invited for the mason, carpenter, slater, plumber, plasterer, and painter works for repairs and improvements at the United Free Church and Manse, Archiestown. The plans and specifications may be seen at the Manse and with Mr. John Wittet, architect, Elgin, with whom tenders must be lodged by September 24.

SEPTEMBER 24.—**Middlesbrough.**—CHURCH.—For the whole or the various works required in the erection of Wesleyan Church, Woodlands-road, Middlesbrough. Names to Messrs. Danby & Simpson, architects, 73, Albion-street, Leeds, not later than September 24, when quantities and other information will be forwarded.

SEPTEMBER 24.—**Pengam.**—HOTEL.—Tenders are required for the erection of new hotel, adjoining the station approach at Pengam (Rhymney Railway) Station, Glam., for Messrs. Griffiths Brothers, Ltd. Bills of quantities can be obtained upon deposit of 1*l.* 1s. Drawings inspected at offices of Messrs. Lansdowne & Griggs, architects, Metropolitan Bank Chambers, Newport, Mon. Tenders must be sent not later than 4 p.m., September 24.

SEPTEMBER 25.—**Abergavenny.**—ADDITIONS TO TOWN HALL, ETC.—Tenders are invited for alterations and additions to the Town Hall, Abergavenny. Plans and specifications may be seen, and bills of quantities obtained (on payment of a deposit of 2*l.* 2s.), at the offices of the architect, Mr. E. A. Johnson, F.R.I.B.A., Abergavenny. Endorsed tenders to be sent to Mr. J. T. Rutherford, Town Clerk, not later than September 25.

SEPTEMBER 25.—**Conna.**—RESIDENCE.—Tenders are invited for the building of a teacher's residence at Conna, according to the plans and specifications to be seen daily at the residence of the Rev. J. Murphy, P.P., Conna. Tenders to be delivered by September 25.

SEPTEMBER 25.—**Kingston-on-Thames.**—CLUB ENLARGEMENT.—The Committee of the Gladstone Liberal Club invite tenders for proposed addition to their premises. Plan and specifications can be obtained of the Secretary, Mr. B. A. Keene, Elm-road, Kingston-on-Thames. Tenders to be delivered not later than noon, September 25.

SEPTEMBER 25.—**Newtonmore, N.B.**—ADDITIONS.—Estimates required for the mason, carpenter, slater, plumber, plasterer, painter, and glazier works of additions to property at Newtonmore. Plans and specifications to be seen with Mr. Alex. Cattanach, architect, The Laurels, Kingussie, who will receive offers up till September 25.

SEPTEMBER 26.—**Belfast.**—ADDITION TO ABATTOIR.—The Market Committee invite tenders for erection of a building at the Abattoir, M'Auley-street. Drawings and specification may be seen in the City Surveyor's Office, and a bill of quantities obtained, on payment of 1*l.* 1s. Sealed tenders on office forms, endorsed "Tender for Abattoir," to be lodged with Sir Samuel Black, Town Clerk, Town Hall, Belfast, before 10.30 o'clock a.m. on September 26.

SEPTEMBER 26.—**Linthwaite.**—WAREHOUSE, ETC.—Tenders are invited for the various works required in the erection of warehouse, dyehouse, offices, and stables, Manchester-road, Linthwaite. Plans may be seen, and quantities obtained, at offices of Messrs. Lunn & Kaye, architects and surveyors, Milnsbridge, to whom sealed and endorsed tenders must be sent no later than 5.30 p.m., September 26.

* SEPTEMBER 27.—**Ashford.**—LAUNDRY.—The Managers of the West London School District invite tenders for the building of a laundry at their schools at Ashford, Middlesex. Copies of the specification, bills of quantities, and tender forms may be obtained, and the drawings and site inspected, on application to Mr. F. G. Beeching, Clerk to the Managers, Ashford, Middlesex, between 10 and 4, with deposit of 5*l.* The site must be inspected. Tenders to the above (as per instructions with the forms) before 6 p.m., September 27.

SEPTEMBER 27.—**Withernsea.**—SCHOOL, ETC.—The Education Committee of the East Riding of the County of York invite tenders for the erection of an infants' school and for additions and alterations to the Council School, Withernsea. Plans and specifications may be seen, and form of tender and copies of quantities obtained, on application to the Building Surveyor, County Hall, Beverley, upon depositing 1*l.* 1s. The plan and specification can also be seen at the Council School, Withernsea. Tenders, endorsed "Withernsea Council School," to be forwarded to Mr. John Bickersteth, Clerk to the East Riding Education Authority, County Hall, Beverley, not later than September 27.

SEPTEMBER 28.—**Havant.**—HOUSE.—Tenders are invited for the erection of a house at Denvilles, Havant. Plans and specifications may be seen at the offices of the surveyors, Messrs. Hall, Pain, & Goldsmith, 48, West-street, Fareham, and quantities and forms of tender obtained. Tenders should be delivered to the surveyors not later than September 28.

* SEPTEMBER 28.—**Hemel Hempstead.**—NEW BRIDGE, ETC.—The Hertfordshire C.C. invite tenders for the rebuilding of a county bridge and works of widening the main road embracing alterations to buildings at Two Waters, Hemel Hempstead. Specifications, agreement, etc., may be seen at the County Surveyor's Offices, Hatfield, between 10 and 4. A copy of the specification and schedule of works and prices and a form of tender can be obtained at the County Surveyor's Office on payment of 2*l.* 2s. Sealed tenders, endorsed "Tenders for New Bridge and Works at Two Waters," must be delivered to Mr. Urban A. Smith, County Surveyor, Hatfield, not later than September 28.

SEPTEMBER 28.—**Saintfield.**—ADDITIONS TO MANSE.—Tenders are invited for making alterations and additions to Second Presbyterian Manse, Saintfield, County Down. Plans and specifications to be seen at the Manse, Saintfield, or at Messrs. Hobart & Heron, architects, 124, Scottish Provident Buildings, Belfast, by whom tenders will be received up to September 28.

SEPTEMBER 28.—**South Elmsall.**—WAREHOUSE, ETC.—For alterations to present shop, erection of warehouse, and stables, at South Elmsall Branch Stores, for the Pontefract Industrial Society, Ltd. Names to the architects, Messrs. Garside & Pennington, Ropergate, Pontefract, and at Castleford. Sealed and endorsed tenders to be forwarded to Mr. W. A. Chappell, Secretary, The Stores, Pontefract, on or before September 28.

SEPTEMBER 28.—**West Bromwich.**—ERECTION OF SMITHY.—Tenders are required for the erection of smithy, etc., at the Walsall and West Bromwich District Schools, West Bromwich. Plans and specifications and conditions of contract may be seen at the offices of Mr. J. W. Allen, architect, High-street, West Bromwich, from whom forms of tender may be obtained. Tenders, under seal and marked "Tenders for Smithy," must be sent to Mr. H. Ward, Clerk, West Bromwich, on or before September 28.

SEPTEMBER 29.—**Ballygawley.**—PAROCHIAL HOUSE IMPROVEMENTS.—Tenders are invited for the building of a wing, and for the execution of improvements, to the Parochial House, Ballygawley, County Tyrone, for the Rev. Peter M'Shane, P.P. Plans and specification may be seen at the Parochial House, Ballygawley; or at the offices of Mr. J. V. Brennan, architect, Belfast Bank Chambers, to whom sealed tenders are to be delivered not later than September 29.

SEPTEMBER 29.—**Coundon.**—ADDITIONS TO INN.—Tenders required for additions to "Hare and Hounds" Inn, Coundon. Plans and specifications may be seen at the office of Mr. T. H. Murray, architect, Consett. Tenders to be sent in on or before September 29.

SEPTEMBER 29.—**Loughrea.**—CHURCH ADDITIONS.—Tenders are invited for works of addition and improvement to Duniry and Abbey churches, Loughrea, for the Rev. Patrick Egan, P.P. Plans and specifications can be seen at Parochial House, Duniry, or at the offices of Mr. William A. Scott, M.S.A., architect, 45, Mountjoy-square, Dublin. Tenders must be delivered on or before September 29.

SEPTEMBER 29.—**Pelynt.**—REPAIRS.—Tenders are invited for the execution of repairs to the buildings, hedges, and gates of the Benefice of Pelynt, Cornwall. Specifications of the works can be seen at the Vicarage, between the hours of 10 and 4. Tenders to be sent not later than September 29, 1906, to Mr. J. M. Strong, Diocesan Surveyor, St. Stephen's, Launceston.

SEPTEMBER 29.—**Penzance.**—SEAMEN'S INSTITUTE.—Tenders are invited for the erection of a Seamen's Institute at Green-street, The Quay, Penzance. Drawings and specifications may be seen at the offices of the architect, Mr. Oliver Caldwell, F.R.I.B.A., Penzance, to whom tenders are to be sent on or before September 29.

OCTOBER 1.—**Warleggan.**—CLOAK-ROOM, ETC.—Cornwall Education Committee invite tenders for proposed new cloak-room, etc., at the Warleggan School, according to plans and specifications, which may be seen at the school or at the office of Mr. B. C. Andrew, Architect to the Committee, Biddick's-court, St. Austell. Forms upon which tenders must be made may be obtained at the school or from the Architect. Sealed endorsed tenders must be sent to Mr. F. B. Pascoe, Secretary, Education Office, Truro, on or before October 1.

OCTOBER 3.—**Nether Alderley.**—SCHOOL ALTERATIONS.—Macclesfield and Hayfield Education Sub-Committee invite tenders for alterations at Nether Alderley Council School. Specification and quantities may be obtained from Mr. H. Beswick, County Architect, Chester. Tenders, addressed to the Chairman, must be sent to Mr. J. Fred. May, Clerk to the Committee, Church Side, Macclesfield, by October 3.

OCTOBER 3.—**Weymouth.**—FERRO-CONCRETE RETAINING WALL.—The Weymouth T.C. invite tenders for constructing and maintaining retaining wall, about 500 ft. in length, of ferro-concrete work (Hennebique's system) on the north side of the Pile Pier within the borough, filling in and levelling up between the existing pier and the intended wall; new fences, Portland stone coping, and other works appertaining thereto. Plans, specification, and condition of contract may be seen, and form of tender obtained, on application at the office of the Borough Engineer, Mr. W. Barlow Morgan, Municipal Offices, Weymouth. Tenders, enclosed in the official envelope, sealed, and endorsed "Retaining Wall Pile Pier," to be delivered to Mr. H. A. Huxtable, Town Clerk, Municipal Offices, Weymouth, on October 3 by 10.30 a.m.

OCTOBER 4.—**Broughton.**—TOWN HALL IMPROVEMENTS.—The Town Halls and Markets Committee invite tenders for additions and alterations to the Town Hall Building, Duke-street, Broughton. Forms of tender and copies of bills of quantities may be obtained, and plans, etc., seen, at the Borough Engineer's Office, Town Hall, Salford. Tenders, endorsed "Broughton Town Hall Extension," and addressed to the Chairman of the Town Halls and Markets Committee, Town Hall, Salford, must be delivered at the office of Mr. L. C. Evans, Town Clerk, Town Hall, Salford, not later than 9.30 a.m. on October 4.

OCTOBER 6.—**Wickham Market.**—WORKHOUSE ADDITIONS.—The Guardians of Plomesgate Union invite tenders for the erection of additions to the infirmary and laundry at the Union Workhouse, Wickham Market, in accordance with the plans and specification, which, with the contract and bond, can be inspected at the Workhouse. Tenders, endorsed "Workhouse Additions," are to be addressed to Mr. T. Waller Read, Clerk, Board-room, Wickham Market, not later than October 6.

OCTOBER 8.—**Carrick-on-Shannon.**—POST OFFICE.—Board of Public Works invite tenders for the erection of a new Crown Post Office at Carrick-on-Shannon, co. Leitrim. The plans and specification can be seen at the Post Office, Carrick-on-Shannon. Forms of tender and bills of quantities will be supplied on deposit of 1*l.* The separate envelopes containing the tender and the bill of quantities must be endorsed, and sent to Mr. H. Williams, Secretary, Office of Public Works, Dublin, not later than 10 a.m. on October 8.

* OCTOBER 11.—**Lambeth.**—ALTERATIONS TO BATHS.—The Lambeth Borough Council invite tenders for alterations and extensions of Baths and Wash-houses in Kennington-road. Plans can be seen, and specification and bills of quantities obtained, at the office of the Borough Engineer, between 10 a.m. and 12 noon and 2 p.m. and 4 p.m. (Saturdays excepted). Sealed tenders, endorsed "Tenders for Building Work, Kennington Baths," to be delivered to the Town Clerk, Town Hall, Kennington Green, not later than 12 noon, October 11.

* OCTOBER 12.—**Newport.**—INFIRMARY.—The Newport (Salop) Guardians invite tenders for the erection of infirmary buildings. Plans and specifications can be seen, and bills of quantities and forms of tender obtained, on application to Messrs. Fleeming & Son, architects, Bank-chambers, Wellington, Salop. Tenders to be delivered to the Clerk to the Guardians, Newport, not later than 9 o'clock a.m., October 12.

* OCTOBER 13.—**Paddington.**—BUILDING BRIDGE.—The Borough Council of Paddington invite tenders for pulling down bridge, and constructing and erecting new brick, concrete, and steel carriageway bridge (30-ft. span), new toll-keeper's office, etc., in and about Warwick-avenue. Forms of tender, specifications, Bills of quantities, etc., obtainable on application to Borough Surveyor. Drawings may be seen, and further particulars obtained, from 10 a.m. to 4 p.m. (Saturdays, 10 a.m. to 1 p.m.), as above. Sealed tenders, endorsed "Reconstruction of Warwick-avenue Bridge." "No. 1 Building Constructional Works," "No. 2 Steel Works," or "No. 3, Nos. 1 and 2 together," to be delivered to the Town Clerk, Town Hall, Paddington, W., not later than October 13.

* OCTOBER 15.—**Coventry.**—BUILDINGS.—The Gas Committee of the Coventry Corporation invite tenders for buildings at their Foleshill Works. The drawings may be seen, and specifications, with form of tender and bill of quantities obtained, on and after October 1, on payment of 1*l.* 1s. Sealed tenders, addressed to the Chairman of the Gas Committee, Gas Works, Coventry, endorsed "Tender for Retort House and Coal Stores, etc.," must be delivered before 9 a.m., October 15.

* OCTOBER 20.—**Stafford.**—SCHOOL.—The Staffordshire Education Committee invite tenders for new high school for girls, Stafford. Builders desiring to tender should apply to Mr. Graham Balfour, Director of Education, County Education Offices, Stafford, on or before October 20. Quantities will be supplied on payment of 2*l.* 2s.

NO DATE.—**Kirkhill.**—HOUSE.—The erection of a house (separate trades) at Kirkhill, Dunbar. Names to Messrs. Davidson & Phillipson, architects, Pearl Buildings, Newcastle-on-Tyne, who will supply particulars and bills of quantities.

NO DATE.—**Royston.**—DWELLING-HOUSE, ETC.—Tenders are invited for building dwelling-house, office, shop, etc., for Royston Gas Company. Apply at the Office, Royston, near Barnsley.

NO DATE.—**Sandsend.**—VILLAS.—Tenders for the erection of a pair of semi-detached villas at "Meadowfields," Eastrow, Sandsend, for Capt. Charles McGregor. Application for quantities to be made to Mr. Thomas Dowson, architect and surveyor Central Chambers, Baxtergate, Whitby.

No Date.—**Tunstall.**—Building Work.—Tenders are invited for new building at the Henry Richards Tile Works, Tunstall. Particulars can be obtained from Messrs. A. B. Wood & Son, architects, Tunstall.

ENGINEERING, IRON, AND STEEL.

September 24.—**Dublin.**—Boilers.—The Improvements Committee of the Corporation of Dublin invite tenders for the supply and erection of two boilers, locomotive type, with necessary steam and water supply pipes, at the East-road Pumping Station. The drawings, specification, and form of tender may be inspected at the office of the City Engineer, City Hall, Dublin, between the hours of 11 and 4 p.m. daily (Saturdays excepted), and copies may be obtained on payment of 1*l.* 1s. Tenders, sealed and addressed to the Chairman of the Improvements Committee, City Hall, Dublin, and endorsed "Tender for Boilers, East-road," must be received by Mr. Patrick Tobin, Secretary Improvements Committee, City Hall, Dublin, not later than 12 o'clock noon on September 24.

September 24.—**Newton Abbot.**—Concrete Bridge.—The U.D.C. of Newton Abbot invite tenders for the construction of a concrete bridge over the stream by Cricket Field-terrace, and other works in connexion therewith. Plans and particulars can be seen at the office of the Surveyor, Lewis Stevens, the Town Hall, Courtenay-street, Newton Abbot, from whom bill of quantities can be had on payment of 1*l.* 1s. Sealed tenders, endorsed "Cricket Field Bridge," to be sent to Mr. Francis Watts, Clerk, 31, Courtenay-street, Newton Abbot, not later than 3 o'clock p.m., September 24.

September 25.—**Manchester.**—Steel Parapet.—The Improvement and Buildings Committee invite tenders for the erection of a steel parapet, etc., at Oxford-street Bridge, over the Rochdale Canal. Drawing may be seen, and specification and form of tender obtained, on application at the City Surveyor's Office, Town Hall, Manchester, on payment to the City Treasurer of 1*l.* 1s. All cheques or postal orders are to be made payable to the order of "The Corporation of Manchester." Tenders, enclosed in the official envelope, and addressed to the Chairman of the Improvement, etc., Committee, to be delivered at the City Surveyor's Office not later than 10 a.m. on September 25.

September 25.—**Stockton-on-Tees.**—Urinal.—The Corporation is prepared to receive tenders for the erection of a urinal in Bowesfield-lane. Plans and specification may be seen, and further information obtained, at the Borough Engineer's Office, Town Hall, Stockton-on-Tees. Tenders, endorsed "Urinal," to be sent to Mr. Arthur B. Crosby, Town Clerk, Borough Hall, Stockton-on-Tees, not later than 10 a.m. on September 25.

* September 25. — **Willesden.** — Wrought-iron Fencing.—The Willesden District Council invite tenders for 2830 ft. lineal of wrought-iron unclimbable adjustable fencing, 4 ft. 6 in. in height, and two pairs of 9-ft. gates of similar pattern to fencing, delivered to New Recreation Ground, Harrow-road, Stonebridge, Willesden, N.W. Specification and form of tender can be obtained on application to Mr. O. Claude Robson, Council's Engineer, Public Offices, Dyne-road, Kilburn, N.W. Tenders, on printed forms (with deposit of 10*l.*), and endorsed "Wrought-iron Fencing, Recreation Ground, Stonebridge," to be delivered at the Offices of the Council, not later than 4 p.m., September 25.

September 26.—**Cardiff.**—Bridge.—Tenders are invited for widening the Masonry Bridge carrying Park-place over the docks feeder. Drawings and specification may be seen, and bills of quantities and forms of tender obtained, on application at the office of Mr. W. Harpur, M.Inst.C.E., City Engineer. Sealed tenders, endorsed "Park-place Bridge Widening," to be delivered at the office of Mr. J. L. Wheatley, Town Clerk, Town Hall, Cardiff, not later than September 26.

September 26. — **Padiham Junction.** — Bridge Widening.—The Directors of Lancashire and Yorkshire Railway invite tenders for the widening of the bridge over the Leeds and Liverpool Canal at Padiham Junction, Rose-grove, near Burnley. Plans and specification can be seen, and form of tender and quantities obtained, on application at the engineer's office, Hunt's Bank, Manchester. Tenders, endorsed "Tender for Widening Bridge at Rose-grove," to be sent to Mr. R. C. Irwin, Secretary, Hunt's Bank, Manchester, not later than 10 a.m., September 26.

September 28.—**Dudley.**—Lancashire Boiler.—The Guardians invite tenders for a new Lancashire boiler to be supplied and fitted at the Workhouse in accordance with specification, to be obtained upon deposit of 1*l.* 1s., from Mr. Gaius W. Coster, Clerk to the Guardians, Union Offices, Dudley, to whom tenders must be sent by 10 o'clock a.m. on September 28.

September 29.—**Blackpool.**—Turbo Plant.—The Electricity and Tramways Committee invite tenders for the supply and fixing of one 800 kw. to 1,000 kw. turbine direct-coupled to one 800 kw. single-phase alternator and one 500 kw. direct-current tramway generator; also for surface-condensing plant. Specification and conditions, with form of tender, may be inspected at the office of Mr. Charles Furness, Borough Electrical and Tramway Engineer, Blackpool, Electricity Works, West Caroline-street, and may be obtained on payment of 3*l.* 3s. Sealed tenders, endorsed "Tender for Turbo-Generators," must be addressed to the Chairman, Electricity and Tramways Committee, West Caroline-street, Blackpool, and be delivered not later than September 29.

September 29.—**Southport.**—Motors, Pumps, etc.—The Corporation of Southport invite tenders for the whole or any portion of the following:—Contract No. 1, electric motors and pumps; contract No. 2, gas engines and pumps; contract No. 3, revolving sprinklers for filter beds; contract No. 4, screening arrangements; required for their new Sewage Works at Crossens. The plans may be inspected and particulars obtained on deposit of cheque for 2*l.* at the office of Mr. R. P. Hirst, Assoc.M.Inst.C.E., Borough Engineer, Town Hall, Southport. Tenders, sealed, and endorsed "Contracts Nos. 1, 2, 3, or 4," to be delivered at the office of Mr. J. Ernest Jarratt, Town Clerk, Town Hall, Southport, on or before 12 noon, September 29.

October 4.—**Weymouth.**—Surface-water Drainage.—The Weymouth U.D.C. invite tenders for the construction of surface-water sewers within their district, with the necessary outlet, flap chamber, overflow weir, manholes, gullies, and other works in connexion therewith. Plans, sections, specification, and conditions of contract may be seen, and quantities and form of tender obtained, on payment of 2*l.* 2s., on application at the office of the Borough Engineer, Mr. W. Barlow Morgan, Municipal Offices, Weymouth. Tenders, enclosed in the official envelope, sealed, and endorsed "Surface-water Drainage," to be delivered to Mr. H. A. Huxtable, Town Clerk, Municipal Offices, Weymouth, on October 4 by 12 o'clock noon.

October 6.—**Warrington.**—Engine Repairs.—The Water Committee invite tenders for repairs to their "Water Lily" pumping engine at Winwick Pumping Station. Particulars may be had from Mr. James Deas, A.M.I.C.E., Water Engineer, Municipal Offices. Tenders to be sent in not later than October 6.

October 13. — **Wimbledon.** — Wood-Cutting Machinery.—The Corporation of Wimbledon invite tenders for the supply, delivery, and fixing complete at the Depôt, Queen's-road, Wimbledon, of a circular saw bench, band sawing machine, and a 12-h.p. electrical motor for driving same. Particulars may be obtained on application to the Borough Engineer and Surveyor, Town Hall, Wimbledon. Sealed tenders, endorsed "Wood-Cutting Machinery," to be delivered at the Town Hall on or before noon on October 13.

October 20.—**Haverfordwest.**—Reconstruction of Meat Market.—The Corporation invite tenders for the reconstruction of the Meat Market, including new steel roof with elliptical lattice-braced principals, etc. The drawings and specifications may be inspected at the Council Chamber, High-street, Haverfordwest, between 10 a.m. and 5 p.m., or at the office of Mr. J. Preece James, architect, Tenby. A deposit of 2*l.* 2s. will be required. Tenders, sealed and endorsed "Reconstruction of Market," on the forms supplied, are to be sent to Mr. R. T. P. Williams, Town Clerk, Haverfordwest, on or before October 20.

No Date.—**Coston and Runhall.**—Foot Bridge.—The Forehoe R.D.C. invite tenders for a new foot bridge over the river, between the Parishes of Coston and Runhall. Particulars may be obtained from Mr. Herbert Wade, District Surveyor, Crownthorpe, Wymondham.

No Date.—**Filey.**—Retorts, etc.—The Filey U.C. invite tenders for the extension of the retort bench and the setting of ten retorts. Particulars may be obtained of Mr. Henry Tobey, Engineer, Malton.

No Date.—**Stechford.**—Brick Culvert.—Construction of a 3 ft. by 2 ft. egg-shaped brick culvert, 400 ft. long, with manholes at the extremities, under the main London and North-Western Railway line at Stechford. Names to Mr. Charles F. Redfern, Surveyor, Whitehall Chambers, 23, Colmore-row, Birmingham.

MISCELLANEOUS.

September 24.—**Alnwick.**—Piling.—R.D.C. of Alnwick invite tenders for piling about forty yards of the inner bank opposite the Major's-terrace at Warkworth. The specification may be seen upon application to Mr. Robt. Moore, Warkworth; or at the office of the clerk, Mr. H. W. Walton, Alnwick, to whom sealed and endorsed tenders are to be delivered before 1.30 p.m. on September 24.

September 27.—**Carlisle.**—Carting, etc.—The Corporation of Carlisle invite tenders for the supply of horses, carts, and men required in the City Surveyor's Department. The contract will be let for a period of one, two, or three years, at the option of the Corporation. Specifications and conditions may be seen, and form of tender obtained, at the office of Mr. Henry C. Marks, M.Inst.C.E., City Engineer and Surveyor, 36, Fisher-street, Carlisle, to whom tenders, sealed and endorsed "Tender for Cartage," must be delivered on or before 10 a.m. on September 27.

September 27.—**St. Austell.**—Steam Roller.—St. Austell R.D.C. invite tenders for the hire, during the months of November, December, and January, or longer if required, of one steam roller, 10 tons in weight, with Morrison's patent scarifier attached. Tenders, marked "Steam Rolling Tender," to be sent to Mr. John Stephens, Clerk, office, Cross-lane, St. Austell, on or before September 27.

September 28. — **Ashford.** — Fencing. — Ashford U.D.C. invite tenders for the supply and fixing complete of approximately 1,284 ft. run of all oak park fencing, 6 ft. high out of ground, at its Warren-lane hospital site. Plan and specification may be seen, form of tender, and information obtained, on application to Mr. William Terrill, Surveyor, at his office, North-street, Ashford, Kent. Sealed tenders, endorsed "Hospital Fencing," to be sent to Mr. John Creery, Clerk to the Council, 11, Bank-street, not later than 5 p.m. on September 28.

September 29.—**Stourton.**—Fencing.—The Rothwell U.D.C. invites tenders for providing and erecting 490 yds. of creosoted red-wood fencing, 6 ft. high, round the New Sewage Disposal Works at Stourton. Also separate tenders for about 9 yds. of iron fencing, 5 ft. high, including fixing at the works. Plans and specifications can be seen, and particulars obtained, at the offices of the engineer, Mr. E. J. Silcock, M.Inst.C.E., 10, Park-row, Leeds. Sealed tenders, endorsed "Stourton Fencing" or "Iron Fencing," must be delivered to Mr. W. Dodgson, Clerk to the Council, Council Offices, Rothwell, near Leeds, not later than September 29.

October 13.—**Ipswich.**—School Furniture.—The Education Committee invite tenders for the supply of (*a*) cupboards and (*b*) desks and other furniture for the Clifford-road and Ranelagh-road Council schools. The tenders must be separate for (*a*) and (*b*), and for each school, and cupboards only may be tendered for, and tenders may be for one school only, if desired. Specifications and information may be obtained from the Committee's Surveyor (Mr. E. T. Johns, Tower Chambers, Tower-street, Ipswich) on deposit with him of 10s. Tenders, endorsed, to be sent to Mr. J. Hepburn Hume, Secretary, Tower House, Tower-street, Ipswich, on October 13.

No Date.—**Hertford.**—Steam Rolling.—The Hertfordshire C.C. invite tenders for the supply of steam road-rollers for use on the main roads in the county. Particulars and form of tender can be obtained on application to Mr. Urban A. Smith, M.Inst.C.E., County Surveyor.

No Date.—**Wetley Rocks.**—Shaft Sinking and Walling.—Tenders are invited by the Westwood Coal and Iron Company for sinking and walling of two shafts on the Westwood Estate, near Wetley Rocks, Staffs. For particulars, apply to the Manager, (Mr. B. Parker), or to Westwood Manor, Wetley Rocks.

PAINTING, etc.

September 24.—**Manchester.**—Painting.—The Paving, Sewering, and Highways Committee invite tenders for painting various bridges over the Rochdale Canal and the River Medlock. Specification and form of tender may be obtained on application at the City Surveyor's Office, Town Hall, Manchester, on payment to the City Treasurer of one guinea. All cheques or postal orders to be made payable to the order of "The Corporation of Manchester." Tenders, enclosed in the official envelope, and addressed to the Chairman of the Paving, etc. Committee, to be delivered at the City Surveyor's Office not later than 10 a.m., September 24.

September 25.—**Leyton.**—Painting.—The Leyton U.D.C. invite tenders for the painting work required to be done to the outside of the Town Hall and Technical Institute, High-road, Leyton; and greenhouse in Oliver-road. Specification and form of tender and other particulars may be obtained from Mr. William Dawson, M.Inst.C.E., the Surveyor to the Council, at his offices, Town Hall, Leyton, between 10 and 4 (10 and 12 on Saturdays). Sealed tenders (in special endorsed envelopes supplied with the forms) must be delivered at the meeting of the council, to be held at the Town Hall, Leyton, on September 25, at 7 o'clock p.m.

September 26.—**Hull.**—Painting, etc.—The Corporation invite tenders for the cleansing, painting, etc., required at the new Central Police-station, Alfred Gelder and Parliament streets. Forms of tender and other particulars may be obtained from Mr. Joseph H. Hirst, City Architect, Town Hall, Hull. Tenders, endorsed "Tender for Cleansing and Painting New Central Police-station," are to be addressed to the Chairman of the Station House Sub-Committee, and delivered at the Town Clerk's Office, Hull, before 10 o'clock on September 26.

September 26.—**Manchester.**—Painting.—The Manchester Guardians of the Poor are prepared to receive tenders for the painting of the Poor Law Offices and the Workhouse in New Bridge-street, Manchester. Specifications may be obtained at the office of Mr. A. J. Murgatroyd, architect, 23, Strutt-street, Manchester, on payment of a deposit of 10s. 6d. Sealed tenders, endorsed "Painting at New Bridge-street," to be delivered to Mr. James Macdonald, Clerk to the Guardians, at the Poor Law Offices, New Bridge-street, Manchester, not later than 3 p.m. on September 26.

September 27.—**Canterbury.**—Painting.—Tenders are invited for painting the exterior of the buildings of the Kent and Canterbury Hospital. The specification can be seen at the hospital, and tenders under sealed cover should be delivered to A. J. Lancaster, Secretary, not later than September 27.

September 27.—**Darlington.**—Painting, etc.—The Corporation invite tenders for painting, etc., the outside of the Fever Hospital. Specification may be seen, and bill of quantities obtained, on application at the offices of Mr. George Winter, Borough Surveyor, Town Hall. Tenders, endorsed "Tender for Painting at Hospital," to be sent to Mr. Hy. G. Steavenson, Town Clerk, on or before September 27.

October 1.—**Hull.**—Painting, etc.—The Guardians of the Sculcoates Union invite tenders for painting, etc., at the Relief Station, St. George's-road, Hull. Forms of tender and all particulars can be obtained, or will be sent by post, on application to Mr. J. H. Wild, solicitor, Clerk to the Guardians, Union Offices, Harley-street, Hull, to whom tenders must be sent not later than 10 o'clock a.m., October 1.

* October 1.—**Marylebone-road, W.**—Painting, etc.—The St. Marylebone Guardians invite tenders for outside painting and repairing works at the Houseless Poor Wards, 86, East-street, Marylebone-road, W. Specifications, forms of tender may be obtained between September 21 and 25, on application to Mr. A. Saxon-Snell, F.R.I.B.A., 22, Southampton-buildings, W.C. Tenders, sealed and endorsed "Tender for Outside Painting Works, etc., Houseless Poor Wards," to be addressed and delivered to the Clerk to the Guardians, Northumberland-street, Marylebone-road, W., on or before 10 o'clock a.m., October 1.

* October 3.—**Winchmore Hill.**—Cleaning and Painting.—The Metropolitan Asylums Board invite tenders for external and internal cleaning and painting works at the Northern Convalescent Fever Hospital, Winchmore Hill, N., in accordance with specification prepared by Mr. W. T. Hutch, Engineer-in-Chief. Specification, conditions of contract, bills of quantities, and form of tender may be inspected at the office of the Board, Embankment, E.C., and bills of quantities and forms of tender can then be obtained on payment of 1*l.* Tenders, addressed as noted on the form, to be delivered at the office of the Board before 10 a.m., October 3.

ROADS, SANITARY, AND WATER WORKS.

September 24.—**Farnham.**—Road Works.—Farnham U.D.C. invite tenders for the levelling, draining, channelling, kerbing, paving, metalling, and making good Adam's Park-road. Plans and specifications may be seen at the office of the Council's Surveyor, South-street, Farnham, Surrey, where the bill of quantities and forms of tender can be obtained any morning between the hours of 9 and 10. Sealed tenders, endorsed "Street Works" on

the outside cover, to be delivered to Mr. Richard Mason, solicitor, Clerk to the Council, 93, West-street, Farnham, on or before 4 p.m. on September 24.

SEPTEMBER 24.—**Halifax.**—PRIVATE IMPROVEMENT WORKS.—The Highways Committee of the Halifax Corporation invite tenders for the execution of private improvement works in a portion of the road between Bank Top Inn and the land belonging to the Lancashire and Yorkshire and Great Northern Joint Railway. Plans and specifications may be seen, and forms of tender obtained, on application to Mr. James Lord, C.E., Borough Engineer, Town Hall, Halifax, upon payment of 1*l.* Tenders, endorsed "Road Behind Bank Top Inn," must be sent to Mr. Keighley Walton, Town Clerk, on or before September 24.

SEPTEMBER 24.—**Ilford.**—ROAD WORKS.—Ilford U.D.C. invites tenders for levelling, metalling, channelling, paving, kerbing, and making good Glencoe-avenue, Eton-road (part of), Oxford-road, Francis-avenue, Francis-road, Elizabeth-road, and Park-road (part of). Plans and specifications may be seen, and form of tender obtained, on application to Mr. H. Shaw, A.M.I.C.E., Surveyor to the Council, Town Hall, Ilford, on payment of a deposit of 2*l.* 2s. Sealed tenders, endorsed "Tender for Private Street Works," must be sent to Mr. John W. Benton, Clerk, Town Hall, Ilford, on or before September 24.

SEPTEMBER 25.—**Redcar.**—PAVING, LEVELLING, ETC.—The Redcar U.D.C. invite tenders for levelling, paving, and making the back and side streets between Hanson-street and Soppett-street, Redcar. Plans and specifications can be seen at the Council Offices, 2, West-terrace, Redcar, on application to Mr. James Howcroft, the surveyor. Tenders, marked "Private Improvements," must be sent to Mr. Alfred H. Sill, Clerk to the Redcar U.D.C., on or before September 25, at 12 o'clock noon.

SEPTEMBER 25.—**Runcorn.**—PATHS.—The U.D.C. of Runcorn invite tenders for excavating, filling up, and forming paths and asphalting same at the Runcorn Cemetery. Particulars may be obtained, and plans seen, at the office of the surveyor and water engineer, Mr. James Wilding, between 9 and 10 a.m. and 2 and 3 p.m., except Saturdays. Tenders to be delivered to Mr. E. Marshall, Secretary, Town Hall, Runcorn, and addressed to the Chairman of the Cemetery Committee, endorsed "Tender for Cemetery Paths," not later than September 25.

SEPTEMBER 25.—**Tynemouth.**—STREET WORKS.—Tenders are invited for executing the following: (1) Paving in Windemere-terrace, and in back lanes north, south, and east of Lansdowne-terrace, North Shields. (2) Paving, etc., in Tynemouth-road, North Shields. Plans and specifications may be seen at the office of John F. Smillie, Borough Surveyor, to whom sealed and endorsed tenders are to be sent not later than 12 noon on September 25.

SEPTEMBER 26.—**Stapleford.**—ROAD WORKS.—Stapleford R.D.C. invite tenders for the completion of Bailey-street and Wellington-street, in the parish of Stapleford. Plans and specifications can be inspected at the office of Mr. F. R. Hawley, Surveyor of the Council, Wood-street, Ilkeston. Tenders marked "Stapleford streets" must be delivered to Mr. Frederic Wm. Fox, Clerk to the Council, Bank Chambers, Beastmarket Hill, Nottingham, on or before September 26.

SEPTEMBER 27.—**Bamford.**—WATER SUPPLY.—The Chapel-en-le-Frith R.D.C. invite tenders for providing and laying of about 1,300 yds. of 3-in. cast-iron pipes, together with the construction of a brick-collecting chamber, and other works connected therewith, at Bamford, Derbyshire. Drawings may be seen, and bills of quantities, specification, and form of tender obtained, on application to the Council's Engineers, Messrs. Swann & Brady, Town Hall, Chapel-en-le-Frith, Stockport, on payment of 1*l.* Tenders to be delivered on or before noon, September 27, endorsed "Tenders Bamford Water," and addressed to Mr. John Burton Boycott, Clerk to the Council, Chapel-en-le-Frith.

SEPTEMBER 27.—**Leamington Spa.**—ROAD WORKS.—The Corporation of Royal Leamington Spa invite tenders for making a short length of roadway. Plans and specification may be seen at the office of their Engineer, at the Town Hall. Tenders, addressed to Mr. Leo. Rawlinson, Town Clerk, Town Hall, Royal Leamington Spa, and endorsed "Tender for Road Making," are to be sent in before noon on September 27.

SEPTEMBER 28.—**Birmingham.**—PRIVATE STREET WORKS.—The Public Works Committee invite tenders for the construction of private street works, including road and sewer construction in Mona-road (off Kingston-road) and Green-street (off Garrison-street). The drawings and specifications may be inspected, and quantities and forms of tender obtained, on deposit of 1*l.*, at the office of Mr. Henry E. Stilgoe, M.Inst.C.E., City Engineer and Surveyor, Council House, Birmingham, where separate tenders for each road are to be sent on or before September 28, endorsed "Tender for Private Street Works."

SEPTEMBER 28.—**Hull.**—ROAD WORKS.—The Corporation invite tenders for paving with concrete and draining certain backways to the south of Spring Bank West and west of Boynton-street. Forms of tender and other particulars may be obtained from Mr. A. E. White, M.Inst.C.E., City Engineer, Town Hall, Hull. Tenders, endorsed "Tender for Backways," are to be addressed to the Chairman of the Works Committee, and delivered at the Town Clerk's Office before noon on September 28.

SEPTEMBER 29.—**Leeds.**—ROAD WORKS.—The Highways Committee invite tenders for making asphalte footpaths, covering the existing pitched foundation of the carriageway with broken granite, and laying channels in Allerton Drive, Chapeltown. Forms of tender and bills of quantities may be obtained, and copies of the documents forming the contract inspected, on application at the Highways Office, 155, Kirkstall-road. Sealed tenders, endorsed "Tender for Private Street Works," and addressed to the Highways Committee, must be delivered at the Town Clerk's Office, Town Hall, Leeds, not later than 10 a.m. on September 29.

OCTOBER 1.—**East Grinstead.**—PRIVATE STREET WORKS.—East Grinstead U.D.C. invites tenders for the sewering (sewage and surface water) and contingent works in Morton-road, and parts of Coronation-road and Stockwell-road. The drawings and specification may be seen, and the form of tender obtained, from Mr. W. E. Woollam, Engineer and Surveyor to the Council, during the usual office hours on depositing postal order value 1*l.* Tenders, endorsed "Tender for Roads, Sunnyside," must be sent to Mr. E. P. Whitley Hughes, Clerk to the Council, on or before October 1.

OCTOBER 2.—**Hove.**—BRICK SEWER, ETC.—The Hove Council invite tenders for constructing a brick sewer in Langdale-road; concrete and stoneware pipe sewers in New Church-road and Wish-road; and other works. Plans, specification, and form of contract may be seen, and bills of quantities and form of tender obtained, at the office of the Borough Surveyor (Mr. Hugh Hamilton Scott), on payment of 5*l.* 5s. Tenders, on the forms provided, endorsed "Tender for Main Drainage Works, Contract No. 2," addressed to Mr. H. Endacott, Town Clerk, Town Hall, Hove, will be received up to 6 o'clock on October 2.

OCTOBER 2.—**Lewisham.**—ROAD WORKS.—The Borough Council invite tenders for kerbing, channelling, and metalling the roadway and paving the footpaths with artificial stone (in separate contracts) of Saravia-road, Lewisham. The plans and specifications may be seen, and forms of tender obtained, at the Town Hall, Catford (Surveyor's Department), and copies of the specification may also be had on payment of 5s. in each case. The tenders must be on forms issued by the Council, enclosed in an envelope, sealed, and endorsed "Tender for Saravia-road," and must be delivered by 4 o'clock on October 2, 1906, at the Town Hall, Catford, S.E.

OCTOBER 2.—**Moreton-in-the-Marsh.**—SEWAGE WORKS.—Chipping Campden R.D.C. invite tenders for the provision, laying, and jointing of cast-iron and stoneware pipe sewers, together with manholes and lampholes, construction of pump well, engine-house, liquefying tanks, and other incidental works, in accordance with the drawings and specification, which may be seen, and bills of quantities and form of tender obtained, at the offices of the engineers, Messrs. Willcox & Raikes, 63, Temple-row, Birmingham, on payment of a deposit of 3*l.* 3s. Sealed tenders in envelopes supplied, endorsed "Moreton-in-the-Marsh Sewerage—Contract No. 1," to be delivered to Mr. Oliver H. New, Clerk to the Council, Chipping Campden, not later than 12 o'clock noon on October 2.

OCTOBER 2.—**Walsall.**—SEWAGE WORKS.—Brownhills U.D.C. invite (Contract No. 1) tenders for the construction of detritus tanks, bacteria filters, and other incidental works in connexion therewith, at the Mosspits Sewage Disposal Works, near Walsall. Plans and specifications may be seen at the offices of the engineers, Messrs. Willcox & Raikes, 63, Temple-row, Birmingham, from whom bills of quantities and form of tender may be obtained on payment of a deposit of 2*l.* 2s. Sealed tenders in envelopes supplied, endorsed "Mosspits Sewage Disposal Works," to be delivered to Mr. T. H. Stanley, Clerk to the Brownhills U.D.C., 35, Bridge-street, Walsall, not later than October 2.

OCTOBER 3.—**Lewisham.**—WOOD PAVING WORK.—The Council invites tenders for supplying and laying creosoted deal blocks in the roadway in High-road, Lee, from High-street, Lewisham, to Lee Green; also for repaving with the same material a portion of the roadway in Tranquil Vale, Blackheath, particulars of which are set out in the specifications and forms of tender. The plans, specifications, and conditions may be seen, and forms of tender obtained, at the Town Hall, Catford (Surveyor's Department). The tenders, enclosed in an envelope, sealed and endorsed "Tender for Wood Paving in ——," must be delivered by 12 o'clock on October 3, at the Town Hall, Catford, S.E.

* OCTOBER 3.—**Tooting.**—TAR PAVING, ETC.—Metropolitan Asylums Board invite tenders for new tar paving and repairs to existing paving at Tooting Bec Asylum, Tooting, S.W. Specification, condition of contract, and form of tender may be inspected at the Board's Office, Embankment, E.C., on and after September 24. Tenders, addressed as noted on form, to be delivered at the Board's Office not later than 10 a.m., October 3.

* OCTOBER 4.—**Bromley.**—ROAD MAKING.—The Councils of Bromley, Beckenham, etc., invite tenders for certain works of sewering, levelling, paving, metalling, channelling, and making good Hayes-road. Plans and sections may be seen, and specifications, bills of quantities, and forms of tender obtained, at the office of the Borough Engineer, Bromley, Kent, on payment of 1*l.* 1s. Tenders, endorsed "Tender for Hayes-road," must be delivered to the Clerk of the Bromley R.D.C., Park House, Beckenham-lane, Bromley, Kent, not later than October 4.

OCTOBER 6.—**Skipton.**—SEWAGE DISPOSAL WORKS.—Contract No. 1.—The Skipton U.D.C. invite tenders for the construction of detritus tanks, sedimentation tanks, continuous filters, the laying out of about twenty acres of land, the construction of a storm-water bed and main, and other works in connexion with their sewage disposal works. The drawings may be seen, and a copy of the specification, schedule of quantities, conditions of contract, and form of tender obtained, on application to the Council's Engineer, Mr. John Mallinson, Town Hall, Skipton, on payment of two guineas. Sealed tenders, in envelopes to be supplied, are to be delivered to Mr. Richard Wilson, Clerk to the Council, not later than October 6.

OCTOBER 8.—**Market Harborough.**—STREET WORKS.—The Market Harborough R.D.C. invite tenders for the construction and making-up of the following streets in the Parish of Kibworth Beauchamp, viz.:—Gladstone-street, Dover-street, Buller-street, Kimberley-street, White-street, and Rosebery-avenue. Plans may be seen at the offices of the Council, and at the offices of the Engineers, Messrs. Everard, Son, & Pick, 6, Millstone-lane, Leicester, from whom quantities and form of tender may be obtained upon payment of 2*l.* 2s. Sealed tenders to be sent to Mr. Charles Burgoine, Clerk to the Council, Market Harborough, not later than 10 o'clock in the forenoon of October 8, endorsed "Tender for Kibworth Roads."

OCTOBER 10.—**Stockport.**—CONSTRUCTION OF SEWERS, ETC.—The Highways and Sewers Committee invite tenders for the manual and team labour and materials required in the construction of about 1,360 lin. yds. of egg-shaped sewers, varying in size from 3 ft. by 2 ft. to 4 ft. by 2 ft. 8 in.; 100 lin. yds. of cast-iron pipe sewers, 15 in. and 21 in. in diameter; and 6,120 lin. yds. of stoneware pipe sewers, varying from 12 in. to 36 in. diameter; together with all manholes and ventilators; the construction of a small detritus tank and screening chamber, and other incidental works for the sewerage of the added areas of Cheadle and Bramhall. Plans, sections, and details may be seen, and conditions, specifications of works and materials, bills of quantities, form of tender, etc., may be obtained, from Mr. John Atkinson, A.M.Inst.C.E., Borough Surveyor, Borough Surveyor's Office, Stockport, on payment of a deposit of 3*l.* 3s. Tenders, addressed "The Borough Surveyor, Stockport," sealed and endorsed "Tender for Sewers in Added Areas of Cheadle and Bramhall," to be delivered at or before noon on October 10.

NO DATE.—**Aboyne.**—ROAD WIDENING.—Estimates wanted for widening the public road opposite Waterside, on Glen Tana Estate. Plans and specifications to be seen with Mr. J. Milne, Road Surveyor, Aboyne.

* NO DATE.—**Wealdstone.**—ROAD AND SEWERS.—Tenders required for about 1,050 ft. of road and sewers at Wealdstone. Specifications, plans, and sections can be seen at the offices of Messrs. Allen & Hoar, surveyors, 283, West End-lane, N.W.

STONE, MATERIALS, AND STORES.

SEPTEMBER 24.—**Sevenoaks.**—ROAD MATERIAL.—The Sevenoaks U.D.C. invite tenders for 2,200 yds. of clean local stone, or any less quantity, according to the specification prepared by the Surveyor to the Council, to be delivered otherwise than by traction engines, on or before October 31, at the various depôts within their district. Sealed tenders to be addressed to Mr. Herbert J. Thompson, Clerk to the Council, Urban Council Offices, Sevenoaks, and endorsed "Tender for Road Metal, etc.," and delivered on or before September 24.

SEPTEMBER 24.—**Surbiton.**—MACADAM.—The U.D.C. of Surbiton invite tenders for the supply and delivery of Rhenish columnar basalt macadam. Specification and forms of tender can be obtained on application to the Surveyor, at the District Council Offices, Surbiton. Tenders, enclosed in sealed envelopes, endorsed "Tender for Basalt Macadam," and addressed to Mr. James Bell, Clerk to the Council, District Council Offices, Surbiton, must be delivered at or before noon on September 24.

SEPTEMBER 25.—**Sheerness.**—ROAD MATERIALS.—Sheerness U.D.C. invite tenders for the following:—(1) Basalt or granite, 350 tons, broken to pass through a 2-in. ring; (2) good clean pit flints, 300 yds, broken to pass through a 2-in. ring; (3) basalt or granite chippings, 20 tons; (4) good clean hoggin for binding purposes, 300 yds. To be delivered in barges alongside the pier at Sheerness at contractor's cost. The Council will unload and cart and pay pier dues. Samples of the materials must be sent to or left with the Surveyor to the Council, Mr. T. F. Berry, and sealed tenders, on forms supplied, stating price per yard or ton, endorsed outside "Tender for Road Material," must be delivered or sent to Mr. Vincent H. Stallon, Clerk of the Council, Council Offices, Trinity-road, Sheerness, before noon on September 25.

SEPTEMBER 26.—**Glasgow.**—STEEL RAILS AND FISHPLATES.—The Corporation of Glasgow invite tenders for the supply of 1,000 to 2,000 tons of rails B.S. Section No. 5, 150 tons B.S. Section No. 5c, and 20 tons fishplates for same. Specification, with form of tender and drawings, can be obtained on application to Mr. James Dalrymple, General Manager, 46, Bath-street, Glasgow, and sealed tenders, endorsed "Tramways—Tender for Steel Rails," must be lodged with Mr. A. W. Myles, Town Clerk, City Chambers, Glasgow, not later than 10 a.m., September 26.

SEPTEMBER 26.—**Halifax.**—GRANITE AND DROSS.—Southowram U.D.C. invite tenders for the supply of granite and dross as follows:—150 tons of granite, to Brighouse Station; 50 tons of granite, to Elland Station; 150 tons of dross, to Brighouse Station; 150 tons of dross, to North Bridge Station, Halifax; 200 tons of dross, to Hipperholme Station. Tenders should be sent, along with sample, carriage paid, to Mr. Councillor J. S. Hartley (Messrs. Hartley & Kaye, North Bridge Stone Wharf, Halifax), and should state the price per ton, at which the material will be delivered at the above-named stations respectively, in such quantities as may be desired by the Surveyor to the Council. All tenders and samples must be delivered not later than September 26, and must be endorsed "Tenders for Granite, etc."

SEPTEMBER 26.—**Newport.**—TIMBER.—Bath and West and Southern Counties Society invite tenders for supplying the timber for the show-yard buildings of the show at Newport (Mon.). Specifications may be obtained of the Secretary, Thos. F. Plowman, 3, Pierrepont-street, Bath, to whom tenders must be sent not later than September 26.

SEPTEMBER 27.—**Grays.**—GRANITE, ETC.—The Grays Thurrock U.D.C. invite tenders for the supply and delivery to the Town Wharf, Grays, of about 600 tons of 1½-in. granite or basalt macadam and 150 tons of ½-in. chippings of the same material. Tenders, which must be on the form to be obtained, with specification, from the Council's Surveyor, at his office, High-street, Grays, and be accompanied by a sample of the material tendered for, are to be delivered to Messrs. Hatten & Asplin, Clerks of the Council, District Council Offices, Grays, by noon on September 27, endorsed "Tender for Macadam."

SEPTEMBER 27.—**Lambeth.**—PAVING STONE.—The Lambeth Metropolitan Borough Council invites

tenders for the supply of 12,000 super. ft. of new 2½-in. York stone paving, "Silex" Brand. Forms of tender can be obtained from Mr. Henry Edwards, C.E., Borough Engineer, 346, Kennington-road, S.E. Sealed tenders, endorsed "Tender for York Stone Paving," must be delivered at the Lambeth Town Hall, Kennington-green, S.E., not later than 12 o'clock noon on September 27.

SEPTEMBER 29.—**Durban, Natal.**—STONEWARE SEWERAGE PIPES.—The Corporation of Durban invite (from manufacturers only) tenders for the supply and delivery ("free on board") of two miles each of 6 in., 7 in., and 8 in. diameter stoneware sewerage pipes. Specifications can be obtained from Mr. W. H. Radford, C.E., Albion-chambers, Nottingham, Consulting and Representative Engineer to the Corporation, on deposit of 1*l.* 1*s.* Sealed and endorsed tenders must be delivered to Messrs. Webster, Steel, & Co., Agents to the Durban Corporation, 5, East India-avenue, Leadenhall-street, London, E.C., on or before September 29. The lowest or any tender will not necessarily be accepted.

✱ SEPTEMBER 29.—**Paddington.**—SHINGLE.—The Borough Council of Paddington invite tenders for supply of fine crushed Thames shingle, granite chippings, or other material for strewing on carriage ways. Forms of tender, etc., to be obtained on application to the Borough Surveyor, Town Hall, Paddington, W., between 10 p.m. and 4 p.m. (Saturdays, 10 a.m. and 1 p.m.). Tenders, sealed and endorsed "Shingle," addressed to the Town Clerk, as above, to be delivered, together with samples, not later than September 29.

OCTOBER 1.—**Sandgate.**—HIGHWAY MATERIALS.—The Sandgate U.D.C. invite tenders for the supply of various highway materials, to be delivered at the cost of the contractor, on or before November 30 next. Forms of tender may be had upon application to Mr. J. Shere Atkinson, Clerk to the Council, Council Offices, 51, High-street, Sandgate, to whom tenders must be sent, marked "Tender for Highway Materials," not later than October 1

✱ OCTOBER 8.—**London.**—STORES.—The Metropolitan Railway Company invite tenders for supply of general stores during twelve months ending October 31, 1907. Application for form of tender to be made after September 27. Samples and patterns of goods may be seen at the office of the Company's Storekeeper, adjoining Neasden Station, N.W., from October 1 to 6 inclusive. Tenders, on forms supplied and endorsed "Tender for ——," must reach the Secretary, 32, Westbourne-terrace, W., not later than 10 a.m., October 8.

Auction Sales.

Nature and Place of Sale.	By whom Offered.	Date of Sale.
✱DEALS, BATTENS, ETC.—Great Hall, Winchester House, Old Broad-street, E.C.	Churchill & Sims	Sept. 26
✱BRICKMAKING PLANT AND MACHINERY, CATFORD—On the Premises	J. T. Skelding	Sept. 27
✱FREEHOLD BUILDING LAND, SHREWSBURY—The County Mart, Shrewsbury	Wm. Hall, Wateridge, & Owen	Sept. 28
✱JOINERY WORKS HENBY-STREET, GRAY'S-INN-ROAD	May & Rowden	Oct. 3
✱BUILDERS' MERCHANT'S STOCK, ETC.—At Frogmore Wharf, Frogmore, Wandsworth, S.W.	J. T. Skelding	Oct. 9
✱FREEHOLD ESTATE, ALTHORNE, ESSEX—At the Mart	Cockett & Henderson	do.
✱ANCASTER HOUSE ESTATE—At the Mart	Chancellor & Sons	October.

PATENTS.—*Continued from page 355.*

3,649 of 1906.—E. C. R. MARKS (Platt, Baker Company): *Detachable Hinge for Windows and the like.*

This relates to a detachable hinge for windows and the like of the type wherein hinged brackets are adapted to slide over projections arranged respectively upon the fixed frame and the sliding sash, and a device upon the fixed frame for locking the bracket in position.

6,872 of 1906.—THE PERFECTOR WINDOW COMPANY, LTD., and W. HIGSON: *Pivoted Sash and Casement Windows.*

This relates to the application to the movable part of a pivoted sash and casement window of a semi-circular bar or plate, which is attached to the movable part of the pivot, and is provided with a number of holes, and consists in the combination therewith of a plate which has one hole, and is attached to the fixed part of the window.

7,076 of 1905.—P. LECHLER: *Radiators and like Heating Apparatus.*

This relates to a heating apparatus having a heating-chamber or shaft the cross-section of which decreases as its distance from the heating source increases, ribs on the shaft, and means for heating and for discharging the combustion gases from the shaft.

9,392 of 1906.—D. J. A. CONCE: *Fire Bars for Stoves, Furnaces, and the like.*

This relates to fire bars for stoves and the like, and consists in constructing each fire bar of two members placed together so that a space exists between their inner facing vertical surfaces, and is characterised by one member having a number of projections proceeding from its inner vertical surface and extending upwards at a distance therefrom, each projection presenting a square upper face. The longitudinal edge of the member is divided by slots into rectangular surfaces, the opposite member being similarly formed with inward projections passing, when the two first members are placed together, between the projections of the first member, a number of fire bars so constructed presenting, when assembled, an upper supporting surface for the fuel, composed of squares like a chess-board, with spaces around each square for the passage of the air and for the falling through of the ashes and refuse.

13,383 of 1906.—H. E. VANCE: *Slats for Constructing Fireproof Curtains, Screens, Shutters, Doors, and the like.*

This relates to a fireproof blind or curtain, and consists of a metallic slat provided at its edge with a hook to which the heat retardent material is applied on both sides, the material on one side extending over the back of the hook, while the material on the other side does not extend to the hook.

16,648 of 1905.—G. L. MOUCHEL: *Armoured Concrete Piles.*

This relates to an armoured concrete pile, comprising a wall of concrete rods with metal disposed longitudinally therein, said rods being securely tied together with a hole throughout the whole or greater part of its length, and without any diaphragm or external metal casing, said hole having a cross-sectional area larger than that of the rod for passing water therethrough as a means for sinking the pile.

16,706 of 1906.—E. G. PERROT: *Reinforced Concrete Structures.*

This relates to reinforcing means for a cementious body, comprising longitudinal main bars or members formed of metallic structural elements, longitudinally extending plates connecting said bars, said bars being separated at other points, and transverse minor elements attached to said longitudinally extending elements where not engaged by said longitudinal plates, said minor elements also connecting parallel longitudinal bars and holding the same in position transversely within the cementitious body.

24,088 of 1905.—J. GRANICH: *Casting Moulds Used for Connecting and Luting Stoneware Pipes.*

This relates to a casting mould for connecting and luting stoneware pipes, consisting of two semi-circular parts forming a ring, the inner surface of which is of such a form that, when mounted on the pipes, a hollow space is formed between the ring and the flange of the adjacent pipe, means to hinge the two parts of the ring on one side, and means to temporarily fasten them on the other side.

1,715 of 1906.—J. S. PULLAN and W. H. MANN: *Brick Moulding or Pressing Machines.*

This relates to a brick moulding or pressing machine in which the pressing plunger is actuated through the medium of a screw, and consists in the combination with the pressing plunger of an internal die or loose plate mounted within a skeleton plate attached to the under face of the plunger, a vertically sliding collar located on the lower end of the actuating screw, and having oppositely situated inclined notches formed therein, and oppositely situated arms pivoted to the plunger, and formed with inwardly directed hooked ends adapted to engage within the inclined notches in the collar. The arrangement is such that, on the screw being actuated, the plunger and internal die are moved down simultaneously until the skeleton plate of the plunger enters the mould to a predetermined distance, when the pivoted hooked arms are caused to move outwardly from the collar into engagement with recesses formed in the press frame to retain the plunger in the down position, and allow the screw to carry the internal die further down within the mould to spread the clay outward to the underside of the skeleton plate, and produce a brick of a standard thickness on its outer edges.

3,182 of 1906.—DR. B. ALEXANDER-KATZ: *Process of Manufacturing Artificial Stone.*

This relates to a process of manufacturing artificial stones from fibrous materials such as asbestos and binding agents such as a slowly-binding cement, in which, by utilising the well-known filtering properties of the asbestos, a mixture of asbestos cement, and but a small quantity of water, is freed from water, felted, and shaped by means of a filter press or filtering drums.

13,348 of 1906.—M. REICH: *Scaffolding.*

This relates to a scaffolding adjustable in vertical direction, consisting of a post cross-shaped in cross-section, guarded in a vertical tube, two angle-irons fixed in the upper end of said tube to form with their parallel shanks guards for the lateral arms of the post, the two shanks of the angle-irons being pressed together to form one flat piece at the part projecting from the upper end of the tube, the said part of the angle-irons as well as the lateral arms of the post being provided with equidistant holes for the reception of the bolts connecting the post with the tube, the post having in its upper end vertical incisions for the reception of the vertical shanks of the L-irons forming the support for the planking, said shanks having equidistant holes for the reception of screw-bolts, which secure the bars in their position.

4,228 of 1906.—A. D'HAVE: *Arrangement of Strengthening Wires for Building in Concrete and the like.*

This invention relates to the construction of floors of strengthened concrete, and consists in the arrangement of wires and the distribution of the weight towards the support of the beams by means of strengthening elements which have four points of attachment, and have the form of elongated letter X. The invention further consists in the construction of the beams, comprising the "compression" and "tension" bars for supporting a floor of the type described, and in the use of cables and of straps or twisted wires to connect the "tension" and compression bars, the cables running through the whole length of the beams, and following the line of bending moment due to the weight of the supported structure.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

September 4.—By G. H. MASTERMAN & CO.	
St. Pancras.—21, Charrington-st., u.t. 16¾ yrs., g.r. 5*l.* 5*s.*, e.r. 52*l.*	£255
September 6.—By MADDISON, MILES, & MADDISON (at Bungay).	
Bungay, Suffolk.—Broad-st., freehold stabling and warehouse, p.	120
Needham, Norfolk.—A freehold holding, 1 a. 0 r. 24 p., y.r. 7*l.*	120
Bedingham, Norfolk.—Two cottages and 0 a. 2 r. 33 p., f.	130
A freehold house and 0 a. 2 r. 27 p.	140
September 8.—By H. J. WAY & SON (at Newport).	
Newchurch, Isle of Wight.—"Langbridge Farm," 82 a. 1 r. 28 p., f., y.r. 160*l.*	3,700
September 11.—By BRADSHAW, BROWN, & CO.	
Cranham, Essex.—"Crouch House" and farm, 87 a. 2 r. 37 p., f. (in lots)	7,425
By OSBORN & MERCER.	
Walthamstow.—52, Grosvenor Park-rd., f., y.r. 27*l.*	350
Tottenham.—12, 13, 14, 15, and 16, Chesnut-rd., f., w.r. 135*l.* 4*s.*	1,320
By MADDISON, MILES, & MADDISON (at Yarmouth).	
Yarmouth.—10 and 11, Row 24, Market-pl. (s.), f., y.r. 16*l.*	135
1, Row 46, North Quay (s.), f., y.r. 7*l.*	120
5, Wordsworth-pl., and cottage adjoining, f.	135
18, Howard-st. North (s.), f., y.r. 17*l.* 10*s.*	300
21, Kent-sq., f., y.r. 12*l.*	265
37 and 38, Well-st., u.t. 18 yrs., g r. 13*s.*	190
5, 6, and 7, Telegraph Cottages, f.	320
9, Queen's-pl., f., y r. 13*l.*	128
Gorleston, Suffolk.—The "Folly," f., y.r. 10*l.*	248
By SPELMANS' (at Norwich).	
Norwich.—Back of the Inns, The "Red Rose," p.h., f., p.	940
25 and 27, Waterloo-rd. (s.), f., y.r. 16*l.*	225
Sept. 12.—By FULLER, MOON, & FULLER.	
Norwood.—Durham Villas, f.g. rents 26*l.*, reversion in 57 yrs.	520
Woodcote-pl., f.g.r. 40*l.*, reversion in 56 yrs.	895
Horley, Surrey.—"Lincoln Lodge" and 37 acres, f., y.r. 80*l.*	2,000

By DOUGLAS YOUNG & Co.

South Kensington.—94, Fulham-rd. (s.), u.t. 44½ yrs., g.r. 20*l.*, y.r. 150*l.* £1,800

Sept. 13.—By W. A. HEAD.

Camberwell.—2 to 20 (even), Dugdale-st., u.t. 16 yrs., g.r., etc., 175*l.*, w.r. 430*l.* 6s. 325

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; p. for possession; e.r. for estimated rental; w.r. for weekly rental; q.r. for quarterly rental; y.r. for yearly rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; la. for lane; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; av. for avenue; gdns. for gardens; yd. for yard; gr. for grove; b.h. beerhouse; p.h. for public-house; o. for office; s. for shops; ct. for court.

TERMS OF SUBSCRIPTION.

"THE BUILDER" (Published Weekly) is supplied DIRECT from the Office to residents in any part of the United Kingdom at the rate of 18s. per annum (52 numbers) PREPAID. To all parts of Europe, America, Australia, New Zealand, India, China, Ceylon, etc., 26s. per annum.

Remittances (payable to J. MORGAN) should be addressed to The Publisher of "THE BUILDER," Catherine-street, W.C.

SUBSCRIBERS in LONDON and the SUBURBS, by prepaying at the Publishing Office 19s. per annum (52 numbers) or 4s. 9d. per quarter (13 numbers), can ensure receiving "The Builder" by *Friday Morning's Post*.

MEETINGS.

FRIDAY, SEPTEMBER 21.

Royal Sanitary Institute (Lectures for Sanitary Officers).—Dr. G. Newman on "Duties of a Sanitary Inspector"—III. 7 p.m.

SATURDAY, SEPTEMBER 22.

Junior Institution of Engineers.—Visit the Knight, Bevan, and Sturge Portland Cement Works of the Associated Portland Cement Manufacturers. Train leaves Charing Cross at 1.25 p.m. for Northfleet.

Institute of Sanitary Engineers.—Visit to Hampton Sewage Works.

MONDAY, SEPTEMBER 24.

Royal Sanitary Institute.—Dr. A. Wellesley Harris on "Infectious Diseases." 7 p.m.

WEDNESDAY, SEPTEMBER 26.

Royal Sanitary Institute.—Dr. A. Wellesley Harris on "Methods of Disinfection." 7 p.m.

FRIDAY, SEPTEMBER 28.

Royal Sanitary Institute.—Dr. A. Wellesley Harris on "Elementary Statistics." 7 p.m.

SATURDAY, SEPTEMBER 29.

Northern Architectural Association.—Students' Sketching Club excursion.

Institute of Sanitary Engineers.—Visit to Engineering and Machinery Exhibition at Olympia.

Incorporated Association of Municipal and County Engineers.—Home district meeting at Windsor. 11 a.m., assemble in the Guildhall; 12 noon, visit to Windsor Castle; 1.30 p.m., luncheon in the Guildhall; 2.30 p.m., drive by brakes to inspect various buildings; 5 p.m., at the Guildhall.

PUBLISHER'S NOTICES.

Nat. Tel., 6113 Gerrard. Telegrams, "The Builder, London."

THE INDEX (with TITLE-PAGE) for VOLUME XC. (January to June, 1906) was given as a supplement with the issue for July 14.

CLOTH CASES for Binding the Numbers are now ready, price 2s. 6d. each: also

READING CASES (Cloth), with Strings price 9d. each

THE NINETIETH VOLUME of "The Builder" (bound), price Twelve Shillings and Sixpence.

SUBSCRIBERS' VOLUMES, on being sent to the Office, will be bound at a cost of 3s. 6d. each.

CHARGES FOR ADVERTISEMENTS.

COMPETITIONS, CONTRACTS, ALL NOTICES ISSUED BY CORPORATE BODIES, COUNTY AND OTHER COUNCILS, PROSPECTUSES OF PUBLIC COMPANIES, SALES BY TENDER, LEGAL ANNOUNCEMENTS, etc., etc.

Six lines or under ..... 6s. 0d.
Each additional line ..... 1s. 0d.

SITUATIONS VACANT, PARTNERSHIPS, APPRENTICESHIPS, TRADE AND GENERAL ADVERTISEMENTS.

Six lines (about fifty words) or under ..... 4s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

Terms for series of Trade advertisements, and for front page and other special positions, on application to the Publisher.

SITUATIONS WANTED (Single-handed—Labour only).

Four lines (about thirty words) or under ..... 2s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

PREPAYMENT IS ABSOLUTELY NECESSARY.

*** Stamps *must not* be sent, but all sums should be remitted by Postal Orders, payable to J. MORGAN, and addressed to the Publisher of "THE BUILDER," Catherine Street, W.C.

Advertisements for the current week's issue are received up to HALF-PAST ONE p.m. on THURSDAY, but "Classification" is impossible in the case of any which may reach the Office after HALF-PAST TWELVE p.m. on that day. Those intended for the Outside Wrapper should be in by TWELVE NOON on WEDNESDAY.

ALTERATIONS IN STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same must reach the Office before TEN o'clock on WEDNESDAY MORNING.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, etc., left at the Office in reply to advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

ADVERTISERS in "THE BUILDER" may have *Replies addressed to the Office*, Catherine Street, Covent Garden, W.C., *free of charge*. Letters will be forwarded if addressed envelopes are sent, together with sufficient stamps to cover the postage. Unused stamps are returned to advertisers the week after publication.

N.B.—The Reply Boxes are not intended for trade lists, circulars, and the like; should these be received, they cannot (if noticed) be forwarded.

AN EDITION Printed on THIN PAPER, for FOREIGN and COLONIAL CIRCULATION, is issued every week.

READING CASES { NINEPENCE EACH. By post (carefully packed) 1s.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.	
Hard Stocks	1 10 0	per 1000 alongside, in river.
Rough Stocks and Grizzles	1 7 0	" " "
Picked Stocks for Facings	2 17 6	" delivered.
Flettons	1 8 0	" at railway depôt.
Red Wire Cuts	1 14 0	" " "
Best Fareham Red	3 12 0	" " "
Best Red Pressed Ruabon Facing	5 0 0	" " "
Best Blue Pressed Staffordshire	3 15 0	" " "
Do. Bullnose	4 0 0	" " "
Best Stourbridge Fire Bricks	3 14 0	" " "
GLAZED BRICKS.		
Best White and Ivory Glazed Stretchers	12 0 0	" " "
Headers	11 0 0	" " "
Quoins, Bullnose, and Flats	16 0 0	" " "
Double Stretchers	19 0 0	" " "
Double Headers	16 0 0	" " "
One Side and two Ends	19 0 0	" " "
Two Sides and one End	20 0 0	" " "
Splays, Chamferred, Squints	20 0 0	" " "
Best Dipped Salt Glazed Stretchers, and Header	12 0 0	" " "
Quoins, Bullnose, and Flats	14 0 0	" " "
Double Stretchers	15 0 0	" " "
Double Headers	14 0 0	" " "
One Side and two Ends	15 0 0	" " "
Two Sides and one End	15 0 0	" " "
Splays, Chamferred, Squints	14 0 0	" " "
Second Quality White and Dipped Salt Glazed	2 0 0	" less than best.
Thames and Pit Sand	7 0	per yard, delivered
Thames Ballast	5 6	" "
Best Portland Cement	27 0	per ton, "
Best Ground Blue Lias Lime	19 0	" "

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 11s. 6d. per yard, delivered.
Stourbridge Fireclay in sacks 27s. 0d. per ton at rly. dpt.

STONE.

	s. d.	
BATH STONE—delivered on road waggons, Paddington Depôt	1 6½	per ft. cube
Do. do. delivered on road waggons, Nine Elms Depôt	1 8½	" "
PORTLAND STONE (20 ft. average)—		
Brown Whitbed, delivered on road waggons, Paddington Depôt, Nine Elms Depôt, or Pimlico Wharf	2 1	" "
White Basebed, delivered on road waggons, Paddington Depôt, Nine Elms Depôt, or Pimlico Wharf	2 2½	" "
	s. d.	
Ancaster in blocks	1 10	per ft. cube, deld. rly. depôt
Beer "	1 6	" "
Greenshill "	1 10	" "
Darley Dale in blocks	2 4	" "
Red Corsehill "	2 2	" "
Closeburn Red Freestone	2 0	" "
Red Mansfield "	2 4	" "
YORK STONE—*Robin Hood Quality.*		
Scappled random blocks	2 10	" "
6 in. sawn two sides landings to sizes (under 40 ft. super.)	2 3	per ft. super., "
6 in. rubbed two sides ditto, ditto	2 6	" "
3 in. sawn two sides slabs (random sizes)	0 11½	" "
2 in. to 2½ in. sawn one side slabs (random sizes)	0 7½	" "
1½ in. to 2 in. ditto, ditto	0 6	" "
COMMON YORK—		
Scappled random blocks	3 0	per ft. cube, "
6 in. sawn two sides landings to sizes (under 40 ft. super.)	2 8	per ft. super., "
6 in. rubbed two sides ditto	3 0	" "
3 in. sawn two sides slabs random sizes)	1 2	" "
2 in. self-faced random flags	0 5	" "
	s. d.	
Hopton Wood (Hard Bed) in blocks	2 0	per ft. cube, deld. rly. depôt.
" " " 6 in. sawn both sides landings	2 7	per ft. super. deld. rly. depôt.
" " " 3 in. sawn both sides random slabs	1 0	" "
" " " 2 in. do.	0 8½	" "

SLATES.

In. In.	£ s. d.	
24×10 best blue Bangor	13 2 6	per 1000 of 1200 at r. d.
20×12 " "	13 17 6	" "
24×10 first quality "	13 0 0	" "
20×12 " "	13 15 0	" "
16×8 " "	7 5 0	" "
20×10 best blue Portmadoc	12 12 6	" "
16×8 " "	6 12 6	" "
20×10 best Eureka unfading green	15 17 6	" "
20×12 " "	18 7 6	" "

SLATES (continued).

In. In.	£ s. d.	
18×10 best Eureka unfading green	13 5 0	per 1000 of 1200 at r.d.
16×8 " "	10 5 0	" "
20×10 permanent green	11 12 6	" "
18×10 " "	9 12 6	" "
16×8 " "	6 12 6	" "

TILES.

	s. d.	
Best plain red roofing tiles	42 0	per 1000 at rly. depôt.
Hip and Valley tiles	3 7	per doz.
Best Broseley tiles	50 0	per 1000 "
Do. Ornamental tiles	52 6	" "
Hip and Valley tiles	4 0	per doz. "
Best Ruabon red, brown, or brindled do. (Edwards)	57 6	" "
Do. Ornamental do.	60 0	" "
Hip tiles	4 0	per doz. "
Valley tiles	3 0	" "
Best Red or Mottled Staffordshire do. (Peakes)	51 9	per 1000 "
Do. Ornamental do.	54 6	" "
Hip tiles	4 1	per doz. "
Valley tiles	3 8	" "
Best "Rosemary" brand plain tiles	48 0	per 1000 "
Best Ornamental tiles	50 0	" "
Hip tiles	4 0	per doz. "
Valley tiles	3 8	" "
Best "Hartshill" brand plain tiles, sand-faced	50 0	per 1000 "
Do pressed	47 6	" "
Do. Ornamental do.	50 0	" "
Hip tiles	4 0	per doz. "
Valley tiles	3 8	" "

WOOD.

BUILDING WOOD.	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	13 10 0	... 15 0 0
Deals: best 3 by 9	13 0 0	... 14 0 0
Battens: best 2½ in. by 7 in. and 8 in., and 3 in. by 7 in. and 8 in.	11 0 0	... 12 0 0
Battens: best 2½ by 6 and 3 by 6	0 10 0	less than 7 in. and 8 in.
Deals: seconds	1 0 0	less thn best.
Battens: seconds	0 10 0	" "
2 in. by 4 in. and 2 in. by 6 in.	9 0 0	... 10 0 0
2 in. by 4½ in. and 2 in. by 5 in.	8 10 0	... 9 10 0
Foreign Sawn Boards— 1 in. and 1½ in. by 7 in.	0 10 0	more than battens.
¾ in.	1 0 0	"
	At per load of 50 ft.	
Fir timber: best middling Danzig or Memel (average specification)	4 10 0	... 5 0 0
Seconds	4 0 0	... 4 10 0
Small timber (8 in. to 10 in.)	3 12 6	... 3 15 0
Small timber (6 in. to 8 in.)	3 0 0	.. 3 10 0
Swedish balks	2 10 0	... 3 0 0
Pitch-pine timber (30 ft. average)	4 0 0	... 4 15 0
JOINERS' WOOD.	At per standard.	
White Sea: first yellow deals, 3 in. by 11 in.	24 0 0	... 25 0 0
3 in. by 9 in.	22 0 0	.. 23 0 0
Battens, 2½ in. and 3 in. by 7 in.	16 10 0	.. 18 0 0
Second yellow deals, 3 in. by 1 in.	18 10 0	... 20 0 0
" " 3 in. by 9 in.	17 10 0	... 19 0 0
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	... 14 10 0
Third yellow deals, 3 in. by 11 in. and 9 in.	13 10 0	... 15 0 0
Battens, 2½ in. and 3 in. by 7 in.	11 0 0	... 12 0 0
Petersburg first yellow deals, 3 in. by 11 in.	21 0 0	... 22 10 0
Do. 3 in. by 9 in.	18 0 0	... 19 10 0
Battens	13 10 0	... 15 0 0
Second yellow deals, 3in. by 11in.	16 0 0	... 17 0 0
Do. 3 in. by 9 in.	14 10 0	... 16 0 0
Battens	11 0 0	... 12 10 0
Third yellow deals, 3 in. by 11 in.	13 0 0	... 14 0 0
Do. 3 in. by 9 in.	12 10 0	... 14 0 0
Battens	10 0 0	... 11 0 0
White Sea and Petersburg— First white deals, 3 in. by 11 in.	14 10 0	... 15 10 0
" " 3 in. by 9 in.	13 10 0	... 14 10 0
Battens	11 0 0	... 12 0 0
Second white deals, 3 in. by 11 in.	13 10 0	... 14 10 0
" " 3 in. by 9 in.	12 10 0	... 13 10 0
" " battens	10 0 0	... 11 0 0
Pitch-pine: deals	18 0 0	... 21 0 0
Under 2 in. thick extra	0 10 0	... 1 0 0
Yellow Pine—First, regular sizes	44 0 0	upwards.
Oddments	32 0 0	"
Seconds, regular sizes	33 0 0	"
Yellow Pine oddments	28 0 0	"
Kauri Pine—Planks, per ft. cube	0 3 6	... 0 5 0
Danzig and Stettin Oak Logs— Large, per ft. cube	0 3 0	... 0 3 6
Small " "	0 2 6	... 0 2 9
Wainscot Oak Logs, per ft. cube	0 5 6	... 0 6 0
Dry Wainscot Oak, per ft. sup. as inch	0 0 8½	... 0 0 9½
¾ in. do. do	0 0 7	... —
Dry Mahogany—Honduras, Tabasco, per ft. super. as inch	0 0 9	... 0 1 0
Selected, Figury, per ft. super. as inch	0 1 6	... 0 2 6
Dry Walnut, American, per ft. super. as inch	0 0 10	... 0 1 0
Teak, per load	17 0 0	... 22 0 0
American Whitewood Planks, per ft. cube	0 4 0	... 0 5 0
Prepared Flooring, etc.—	Per square.	
1 in. by 7 in. yellow, planed and shot	0 13 6	... 0 17 6
1 in. by 7 in. yellow, planed and matched	0 14 0	... 0 18 0
1¼ in. by 7 in. yellow, planed and matched	0 16 0	... 1 0 0
1 in. by 7 in. white, planed and shot	0 12 0	... 0 14 6
1 in. by 7 in. white, planed and matched	0 12 6	... 0 15 0
1¼ in. by 7 in. white, planed and matched	0 15 0	... 0 16 6
¾ in. by 7 in. yellow, matched and beaded or V-jointed brds.	0 11 0	... 0 13 6
1 in. by 7 in. " "	0 14 0	... 0 18 0
¾ in. by 7 in. white " "	0 10 0	... 0 11 6
1 in. by 7 in. " "	0 12 9	... 0 15 0

6 in. at 6d. to 9d. per square less than 7 in.

JOISTS, GIRDERS, &c.

	In London, or delivered Railway Vans, per ton. £ s. d.		£ s. d.
Rolled Steel Joists, ordinary sections	7 0 0	...	7 10 0
Compound Girders, ordinary sections	9 0 0	...	10 0 0
Steel Compound Stanchions	12 0 0	...	13 0 0
Angles, Tees, and Channels, ordinary sections	9 0 0	...	10 0 0
Flitch Plates	9 0 0	...	10 0 0
Cast Iron Columns and Stanchions including ordinary patterns	7 10 0	...	8 10 0

METALS.

	Per ton, in London. £ s. d.		£ s. d.
IRON—			
Common Bars	8 0 0	...	8 10 0
Staffordshire Crown Bars, good merchant quality	8 10 0	...	9 0 0
Staffordshire "Marked Bars"	10 10 0	...	—
Mild Steel Bars	8 15 0	...	9 0 0
Hoop Iron, basis price	9 5 0	...	9 10 0
" Galvanised	17 0 0	...	—
" (*And upwards, according to size and gauge.)			
Sheet Iron Black—			
Ordinary sizes to 20 g.	9 10 0	...	—
" " 24 g.	10 10 0	...	—
" " 26 g.	12 0 0	...	—
Sheet Iron, Galvanised, flat, ordinary quality—			
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.	14 0 0	...	—
Ordinary sizes to 22 g. and 24 g.	14 10 0	...	—
" " 26 g.	15 0 0	...	—
Sheet Iron, Galvanised, flat, best quality—			
Ordinary sizes to 20 g.	17 0 0	...	—
" " 22 g. and 24 g.	17 10 0	...	—
" " 26 g.	19 0 0	...	—
Galvanised Corrugated Sheets—			
Ordinary sizes 6 ft. to 8 ft. 20 g.	14 0 0	...	—
" " 22 g. and 24 g.	14 10 0	...	—
" " 26 g.	15 15 0	...	—
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker	11 10 0	...	—
Best Soft Steel Sheets, 22 g. & 24 g.	12 10 0	...	—
" " " 26 g.	14 15 0	...	—
Cut Nails, 3 in. to 6 in. (Under 3 in., usual trade extras.)	9 10 0	...	9 15 0

LEAD, &c.

	Per ton, in London. £ s. d.		£ s. d.
LEAD—Sheet, English, 3lb. and up.	20 15 0	...	—
Pipe in coils	21 5 0	...	—
Soil pipe	23 15 0	...	—
Compo pipe	23 15 0	...	—
ZINC—Sheet—			
Vieille Montagne ton	33 10 0	...	—
Silesian	33 5 0	...	—
COPPER—			
Strong Sheet per lb.	0 1 1	...	—
Thin " "	0 1 2	...	—
Copper nails "	0 1 0	...	—
BRASS—			
Strong Sheet "	0 1 0	...	—
Thin " "	0 1 1	...	—
TIN—English Ingots "	0 1 9	...	—
SOLDER—Plumbers' "	0 0 8½	...	—
Tinmen's "	0 0 10½	...	—
Blowpipe "	0 0 11½	...	—

ENGLISH SHEET GLASS IN CRATES OF STOCK SIZES.

15 oz. thirds	2½d.	per ft.	delivered.
" fourths	1¾d.	"	"
21 oz. thirds	3½d.	"	"
" fourths	2½d.	"	"
26 oz. thirds	4¼d.	"	"
" fourths	3¼d.	"	"
32 oz. thirds	5d.	"	"
" fourths	4¼d.	"	"
Fluted Sheet, 15 oz.	3¾d.	"	"
" 21 oz.	4¾d.	"	"

ENGLISH ROLLED PLATE IN CRATES OF STOCK SIZES.

¼ Hartley's	2½d.	per ft.	delivered.
¼ "	2¾d.	"	"
¼ "	3d.	"	"
Figured and Oxford Rolled "Oceanic" Glass, white	4d.	"	"
Do. " tinted	5¼d.	"	"

OILS, &c.

		£ s. d.
Raw Linseed Oil in pipes	per gallon	0 1 9
" " " in barrels	"	0 1 10
" " " in drums	"	0 2 0
Boiled " " in pipes	"	0 1 11
" " " in barrels	"	0 2 0
" " " in drums	"	0 2 2
Turpentine in barrels	"	0 3 10
" in drums	"	0 4 0
Genuine Ground English White Lead	per ton	23 10 0
Red Lead, Dry	"	22 10 0
Best Linseed Oil Putty	per cwt.	0 7 0
Stockholm Tar	per barrel	1 13 0

VARNISHES, &c.

	Per gallon. £ s. d.
Fine Pale Oak Varnish	0 8 0
Pale Copal Oak	0 10 6
Superfine Pale Elastic Oak	0 12 6
Fine Extra Hard Church Oak	0 10 0
Superfine Hard-drying Oak, for seats of Churches	0 14 0
Fine Elastic Carriage	0 12 6
Superfine Pale Elastic Carriage	0 16 0
Fine Pale Maple	0 16 0
Finest Pale Durable Copal	0 18 0
Extra Pale French Oil	1 1 0
Rosshell Flatting Varnish	0 18 0
White Copal Enamel	1 4 0
Extra Pale Paper	0 12 0
Best Japan Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 8 6
Berlin Black	0 16 0
Knotting	0 10 0
French and Brush Polish	0 10 0

TO CORRESPONDENTS.

NOTE.—The responsibility of signed articles, letters, and papers read at meetings rests, of course, with the authors.

We cannot undertake to return rejected communications; and the Editor cannot be responsible for drawings, photographs, manuscripts, or other documents, or for models or samples, sent to or left at this office, unless he has specially asked for them.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

All communications must be authenticated by the name and address of the sender whether for publication or not. No notice can be taken of anonymous communications.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article, or to execute or lend a drawing for publication, is given subject to the approval of the article or drawing, when received, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance. The Editor cannot undertake to read and consider articles offered for acceptance unless they are type-written.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and not to the Editor.

TENDERS.

Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than* 10 *a.m. on Thursdays.* [N.B.—We cannot publish Tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of Tenders accepted unless the amount of the Tender is stated, nor any list in which the lowest Tender is under 100*l.*, unless in some exceptional cases and for special reasons.]

* Denotes *accepted.* † Denotes *provisionally accepted.*

ACCRINGTON.—For building a small villa, for Dr. Frankish, Accrington. Mr. W. E. Wood. Quantities by Mr. W. E. Wood:—

Mason: W. H. Bury & Son, Oswaldtwistle
Joiner: R. Huxbury, Oswaldtwistle
Slater: E. Welch, Accrington
Plasterer: G. Eastwood, Accrington
Plumber: R. T. Kenyon, Rishton
} As per schedule.

BRADFORD (Devonshire).—For alterations, general repairs, painting, etc., at Council school, for Education Committee. Mr. P. Morris, Architect, 1, Richmond-road, Exeter:—

W. A. Beckley	£399 9 1	Ridge, Prior, & Harding, Bideford* ..	£328 10 0
W. Perkin	368 8 3		

BRIXHAM (Furzeham Hill).—For alterations and additions and tar-paving the playgrounds of the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

Hazlewood Bros.	£853 5 0	F. A. A. Stacey	£740 0 0
T. Silley	850 0 0	Hayman & Wills, Brixham* ..	680 16 10
Hazlewood & Son	776 1 6		

CARMARTHEN.—For building a sanitary block at Carmarthenshire Infirmary. Messrs. J. Morgan & Sons, architects:—

W. Davies, St. Catherine-street, Carmarthen .. £352

CHADDERTON.—For the construction of sewers for the sewerage of Middleton Junction district, for the Urban District Council. Messrs. J. Diggle & Son, engineers, Hind-hill-street, Heywood, and Westminster:—

T. Turner, Heywood £3,220 12 7

CHEVINGTON (Northumberland).—For parish hall, etc. Mr. A. B. Plummer, F.R.I.B.A., 13, Grey-street, Newcastle-on-Tyne:—

First Contract, Exclusive of Boundaries, etc.
R. & G. Brown, Amble, Northumberland† .. £631 8 5

COMBE MARTIN.—For additions and alterations at the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter. Quantities by Mr. S. W. Haughton, 22, Courtenay-street, Plymouth:—

F. A. A. Stacey	£1,769 0 0	R. Goss & Son, Combe Martin*	£1,195 13 7
Burgess & Lovering ..	1,199 5 1	Woodman & Son‡	1,179 0 0

‡Withdrawn.

COWPEN.—For flagging the bottom and slopes of a settling pond at Choppington Colliery, for the Urban District Council. Mr. R. Grieves, Surveyor, Seaforth-street, Blyth:—

A. Best	£337 13 0	J. Robson, Newcastle-on-Tyne*	£229 9 3
Burn Bros.	267 19 3		
W. Robertson..	267 0 6		

DARTMOUTH.—For demolishing and rebuilding the "Globe Inn," South-embankment, for Messrs. J. Bartlett & Co. Mr. R. Montague Luke, C.E., 15, Princess-square, Plymouth:—

T. Vanstone ..	£580 0 0	G. B. Andrews	£397 0 0
R. E. Narracott	550 0 0	M. Bridgeman	387 18 11
H. Drew.....	480 0 0	F. W. Gullett, Dartmouth*..	349 0 0
Back & Watts	434 0 0		
Yoe & Sons ..	414 0 0		

DUNSFORD.—For alterations and additions to the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

F. J. Zealley	£365 0	A. J. Parker, Newton Abbot*	£286 18
		Kingwell & Castle	284 0

DEVONPORT.—For levelling, paving, and completing the following lanes, viz.:—Contract 95—lane between Maristow and Cotehele avenues (sect. 2); Contract 96—lane between Maristow and parts of St. Aubyn and St. Michael avenues; Contract 98—lane rear of Monument-street; Contract 101—lane between Herbert-place and Haddington-road; Contract 105—lane between Ocean-street and Renown-street (sect. 1), for the Devonport County Council. Mr. J. F. Burns, Borough Surveyor, Municipal Offices, Ker-street, Devonport:—

Contract 95.

Shawdon & Sons	£457 5 10	T. Doney	£421 11 2
Jefford & Son	431 18 6	Pethick Bros., Plymouth*..	413 17 6

Contract 96.

Shawdon & Sons	£311 1 1	Pethick Bros., Plymouth* ..	£291 5 6
Jefford & Son ..	307 6 2		
T. Doney	300 3 11		

Contract 98.

Shawdon & Sons	£143 13 0	T. Doney	£136 1 11
Jefford & Son	139 6 5	Pethick Bros., Plymouth*..	131 14 6

Contract 101.

Shawdon & Sons	£346 0 1	Pethick Bros., Plymouth* ..	£305 8 0
T. Doney	328 8 0		
Jefford & Son ..	325 10 0		

Contract 105.

Shawdon & Sons	£445 11 3	T. Doney	£409 11 8
Jefford & Son	424 19 11	Pethick Bros., Plymouth*..	406 4 0

EDMONTON.—For the following works at the Workhouse, situated at Upper Edmonton, near Silver-street Station (G.E. Rlwy.):—1. General exterior repairs, cleaning, painting, etc. 2. (*a*) Repairs to roof of laundry building, and alternately; (*b*) Construction of new roof altogether for the Strand Guardians. Mr. A. A. Kekwick, architect, 18 and 19, The Outer Temple, Strand:—

General Exterior Repairs, Painting, etc., at Workhouse.

A. Monk	£945 0	F. W. Harris & Co., Ltd.	£439 0
T. G. Sharpington	908 0	H. Wilmott.....	429 0
Love & Co.	875 0	J. Johnson	410 0
W. D. Ridgway ..	650 0	W. Moore & Son..	399 0
J. Stewart	556 0	Limmer & Gallow-way	301 15
Barrett & Power	538 0	P. McCarthy, 441, Fulham-road*..	297 0
J. J. Richards....	524 0		
A. Porter.....	493 0		

Repairs to Roof of Laundry.

F. W. Harris & Co., Ltd.	£340 0	T. G. Sharpington	£242 0
Barrett & Power	313 0	Love & Co., Exeter-street, Strand*	205 0
A. Monk	265 0	J. Stewart	198 15

FINCHLEY.—For erecting a cold water softening plant, for the Urban District Council. Mr. E. Calvert, electrical engineer, Squire's-lane, Finchley, N.:—

Kennicott Water Softener Co., 29, Great St. Helens, E.C.* £390 10

GRIMSBY.—For the erection of public conveniences. Mr. H. Gilbert Whyatt, A.M.Inst.C.E., Borough Engineer and Surveyor, Town Hall, Grimsby:—

—	River Head.	Newmarket-street Foot bridge.	Rear of Palace Theatre.
	£ s. d.	£ s. d.	£ s. d.
Holmes & Richardson ..	235 10 0	95 10 0	215 0 0
R. G. Kitchen	233 15 0	89 0 0	216 0 0
W. Gilbert, Grimsby* ..	227 19 6	88 12 6	206 8 6

HARTLAND.—For repairs, painting, etc., and for new drainage works and alterations to offices at Council school, for Devon County Education Authority. Mr. P. Morris, Architect, 1, Richmond-road, Exeter:—

S. Cann	£341 0 3	Ridge, Prior, & Harding, Bideford* ..	£307 16 6
I. Cock.....	328 5 6		
Lee & Ellis	314 19 0		

HENLEY-ON-THAMES.—For converting school building into an infirmary, for the Guardians. Messrs. C. Smith & Son, architects, 164, Friar-street, Reading:—

C. W. Cox	£1,800 0	Walden & Cox ..	£1,400 0
W. Hawkins	1,700 0	H. Harris	1,316 0
McC. E. Fitt	1,685 0	Batten Bros.	1,285 0
Godwin	1,652 0	M. Payne & Co...	1,280 0
Martin, Wells, & Co.	1,600 0	T. Stimson.....	1,910 5

HITTISLEIGH.—For general repairs and alterations at the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

Dart & Francis	£195 0 0	Counter & Glandfield, South Zeal*	£101 9 0
H. Berry	185 0 0		
E. Gillard & Son	120 18 6	Partridge & Endacott	97 18 6
W. Backwell ..	118 3 0		

ISLEWORTH.—For reconstruction of Oak Bridge, for the Heston and Isleworth Urban District Council. Mr. J. G. Carey, Acting Surveyor:—

C. Gray	£1,100 0	W. W. Muirhead & Co.....	£520 0
J. Mowlem & Co.	780 0	Langley & Johnson, Slough, Bucks*	418 0
Rawkins & Jackson	674 0		
T. Watson, jun.	620 0		
Hughes & Stirling	606 10		

ISLEWORTH.—For reconstruction of Queen's Bridge, for the Heston and Isleworth Urban District Council. Mr. J. G. Carey, Acting Surveyor:—

C. Gray	£1,300	Rawkins & Jackson	£903
J. Mowlem & Co. ..	1,176	W. Muirhead & Co.	850
T. Watson, jun. ..	966	Langley & Johnson, Slough, Bucks* ..	671
Hughes & Stirling..	935		

LIDGATE.—For rebuilding a bridge, for Moulton Rural District Council. Messrs. Holland & Son, Newmarket. Quantities by Messrs. Holland & Son:—

H. W. Kelty	£280 0	J. C. & R. B. Whitmore	£227 0
Mason & Son	248 0	E. E. Simpson ..	198 10
S. Rolfe, Cheveley, Newmarket* ..	225 0		

LINCOLN.—For alterations to the Black Goats Hotel, High-street, for Mr. J. H. Newton. Messrs. Sheppard & Lockton, architects, Bargate, Newark-on-Trent:—

W. Wright & Son	£998 0 0	Grimsby Contracting Co.	£860 6 1
C. Baines	985 0 0	G. Henderson	842 11 0
S. & R. Horton	975 2 8	H.S. & W. Close, Lincoln*	833 0 0
P. McGinnis	900 0 11	Co-Operative Society	800 0 0
G. Brown & Son	863 5 0		

LONDON.—For iron bridges at the workhouse, Ladywell, S.E., for the Bermondsey Board of Guardians. Messrs. Newman & Newman, 31, Tooley-street, S.E.:—

Jones & Co.	£660	General Iron Foundry Co., Ltd.	£601
Spencer, Santo, & Co.	650	J. A Renwick	566
Hayward Bros. & Eckstein	635	W. Reason	539

MALDON.—For water scheme, Mayland, for the Mayland Rural District Council. Messrs. Price & Belsham, engineers, 52, Queen Victoria-street, E.C.:—

Rawkins & Jackson	£1,166 6 6	C. J. Ell	£867 9 10½
Griffiths & Co.	1,146 12 6	D. Young	860 11 0
J. & F. May	1,145 13 6	King & Camping	855 1 0
W. Lewellen	1,007 2 0	Davis, Ball, & Co.	829 13 0
D. Iles	985 0 0	A. Wooldridge	811 7 6
E. B. Trussell	975 10 0	Buxton & Jenner	809 12 0
Jenkins & Sons	962 3 3	F. Collingwood	802 0 0
F. C. Thurman	941 2 0	Crouch Valley Brick and Tile Co.	800 0 0
E. P. Ball & Co.	937 9 8	W. Johnson	795 4 10
J. R. Jones	920 1 3	J. W. Dean, Ltd.	785 10 0
W. Westwood	892 13 6	Reade & Sons, Westminster*	764 14 0
Wilson, Border, & Co.	890 7 8	James & Co.‡	757 0 0
G. H. Hughes	880 1 6	W. L. Meredith§	690 0 0
E. Tabor	873 17 6		
G. Double	867 15 3		

‡ Informal. § Withdrawn.

MEMBURY.—For alterations and additions to the Council school, for the Devon County Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter. Quantities by Mr. S. W. Haughton, 22, Courtenay-street, Plymouth:—

C. Turner	£867 14 6	H. J. Spiller & Son, Taunton*	£711 0 0
Parsons Bros. & Dunster	764 0 0		

NEWCASTLE-ON-TYNE.—For new parochial buildings, St. Judes. Mr. A. B. Plummer, F.R.I.B.A., Diocesan Architect, 13, Grey-street, Newcastle-on-Tyne:—

J. & W. Lowry, Newcastle-on-Tyne £2,699

PONTYCYMMER.—For erecting a school-hall, for the English Calvinistic Methodist Church. Mr. A. Lloyd Thomas, architect and engineer, Church-street-chambers, Pontypridd:—

T. Heartby	£827 0 0	T. Longher	£596 4 3
T. Roberts & Co.	727 0 0	D. J. Davies, Blaengarw*	574 0 0
G. Jones	620 0 0		
T. & S. Jones	610 0 0		

RADSTOCK.—For alterations and additions to the riverside premises, for the Radstock Co-operative and Industrial Society. Mr. W. F. Bird, architect, Midsomer Norton, Somerset. Quantities by the architect:—

W. Webb	£1,845 0	E. C. Harvey	£1,459 19
H. A. Forse & Sons	1,840 0	W. Tovey	1,410 0
W. & J. Bennett	1,620 0	J. Bird	1,400 0
A. E. Denby & Co.	1,599 0	T. Foster, Radstock*	1,382 0
W. J. Heal	1,598 0		
A. T. Waterhouse	1,583 17		

RADSTOCK.—For alterations and renovations to the Wells Way Inn, for Messrs. Thatchers Breweries, Ltd., Welton, Midsomer Norton. Mr. W. F. Bird, Midsomer Norton, Somerset. Quantities by the architect:—

H. A. Forse & Sons	£920 0 6	W. & A. Edgell	£599 0 0
T. Foster	916 0 0	W. J. Heal	597 7 6
W. G. Bindon	880 0 0	W. A. Catley, Midsomer, Norton*	552 0 0
W. & J. Bennett	850 0 0	G. Bishop	470 0 0
J. Hatherley	757 0 0		
A. E. Denby & Co.	675 0 0		
J. Bird	628 9 8		

SHEFFIELD. — For underground conveniences adjoining the Town Hall in Surrey-street, for the Health Committee. Mr. C. F. Wike, C.E., City Surveyor, Town Hall, Sheffield:—

Mellowes & Co., Ltd., Sheffield* £1,334

SEAFORD.—For the construction of 1,300 yds. of 9-in. pipe sewer, etc., in Firle-road and Blatchington-street, for the Urban District Council. Messrs. Pollard & Tingle, engineers, 31, Old Queen-street, Westminster, S.W.:—

Hawkins & Jackson	£1,523 0 0
W. Hill & Co.	1,443 0 0
H. Young	1,441 5 9½
E. & E. Iles	1,396 0 0
G. Napier & Sons	1,290 0 0
E. J. King	1,267 14 7
J. G. Porter	1,249 0 0
H. Williams	1,175 19 0
A. F. Lee	1,122 6 8
Grounds & Newton	1,111 0 0
G. Wimpey & Co.	1,108 0 0
J. Jackson	1,089 17 6
H. A. Chambers	1,052 15 0
A. Streeton & Co.	1,031 4 7
G. G. Raynor	997 0 0
W. L. Wallis & Co., Eastbourne*	950 0 0

SUTTON-ON-SEA (Lincolnshire).—For demolishing lifeboat-house and erecting enlarged boat-house, for the Royal National Lifeboat Institution. Mr. W. T. Douglass, engineer and architect, 15, Victoria-street, Westminster, S.W.:—

H. Till	£939 0 0	J. Arundel	£745 0 0
W. Fasey	900 0 0	F. M. Thompson & Sons	737 0 0
E. Emerson	861 10 10	C. Williamson	699 0 0
J. Crawshaw	841 0 0	S. Loach	686 13 0
K. Miller & Sons	759 11 4	F. Moore, Sutton-on-Sea*	650 0 0
J. G. Holmes & Sons	750 0 0	J. Richardson	624 5 7
Mawer Bros.	749 0 0		

TAVISTOCK.—For new offices at the Council school, for the Devon Education Committee. Mr. P. Morris, architect, 1, Richmond-road, Exeter:—

J. N. Hill	£249 15	T. Symons, Whitchurch*	£175 19
H. J. & J. Minhinnick	235 0		

UCKFIELD.—For 1,620 sq. yds. of concrete paving, etc., for the Urban District Council. Messrs. Overton & Scott, 22, Ship-street, Brighton. Quantities by Messrs. Overton & Scott:—

E. H. King, Chapel-road, Worthing .. £938 14 3

WARKWORTH.—For 606 yds. of 3-in. cast-iron socket pipes and fittings, for Alnwick Rural District Council. Mr. M. Temple Wilson, Surveyor:—

Reavell Bros., Alnwick* £143 1

WREXHAM.—For erecting a new post-office, for the Commissioners of H.M. Works and Public Buildings:—

		Credit.
R. Allen	£4,319 19 6	£34 18 6
Mayar	3,898 0 0	—
Davies Bros.	3,437 6 0	10 6 6
W. E. Samuel	3,395 0 0	30 0 0
Dennis, Gill, & Son	3,298 8 3	—
H. Kelly & Bro.*	3,182 0 0	35 0 0

J. J. ETRIDGE, Jr.

SLATE MERCHANT,

SLATER & TILER.

Penrhyn-Bangor,
Oakeley-Portmadoc.

BEST WORK ONLY.

Red Sandfaced Nibbed Roofing Tiles always in Stock.

Applications for Prices, etc., to

BETHNAL GREEN SLATE WORKS,
Bethnal Green, London, E.

The BATH STONE FIRMS, Ltd., BATH.

For all the Proved Kinds of

BATH STONE.

FLUATE, for Hardening, Waterproofing, and Preserving Building Materials.

HAM HILL STONE.
DOULTING STONE.

The Ham Hill and Doulting Stone Co., Limited
(incorporating the Ham Hill Stone Co. and C. Trask & Son, The Doulting Stone Co.).

Chief Office:—Norton, Stoke-under-Ham, Somerset.

London Agent:—Mr. E. A. Williams, 16, Craven-street, Strand.

Asphalte.—The Seyssel and Metallic Lava Asphalte Company (Mr. H. Glenn), Office, 42, Poultry, E.C.—The best and cheapest materials for damp courses, railway arches, warehouse floors, flat roofs, stables, cow-sheds and milk-rooms, granaries, tun-rooms, and terraces. Asphalte Contractors to the Forth Bridge Co.

SPRAGUE & CO., Ltd.,
LITHOGRAPHERS AND PRINTERS.
Estate Plans and Particulars of Sale promptly executed.
4 & 5, East Harding-st., Fetter-lane, E.C.

QUANTITIES, etc., LITHOGRAPHED accurately and with despatch. [Telephone No. 634 Westminster.
METCHIM & SON {8, PRINCES STREET, S.W., and 32, CLEMENT'S LANE, E.C.
"QUANTITY SURVEYORS' DIARY & TABLES," For 1906, price 6d., post 7d. In leather, 1/-, post 1d.

GRICE & CO., STONE MERCHANTS,
ADDISON WHARF, 191, Warwick Rd., KENSINGTON,
FOR ALL THE BEST
Building & Monumental Stone
A LARGE STOCK OF BEST
CAEN Stone { For HOME TRADE and EXPORT,
in Block, Slab, and Scantling.

ASPHALTE
For Horizontal & Vertical Damp Courses.
For Flat Roofs, Basements, & other Floors.

Special attention is given to the above by
THE
French Asphalte Co.
CONTRACTORS TO
H.M. Office of Works, The School Board for London, &c.
For estimates, quotations, and all information apply at the Offices of the Company.
5, LAURENCE POUNTNEY HILL,
CANNON STREET, E.C.

"Drop Dry" Glazing

ECONOMICAL, EFFECTIVE. THE PERFECT SELF-SUSTAINING BAR.

Copper & Zinc Roofing.

The most Efficient and Economical System in the Kingdom.

Designs and Estimates Free on Application.

Telegraphic Address: "COURTEOUS, LONDON."
F. BRABY & CO., LTD.
Telephones: Nos. 783 and 457 North.

Chief Offices: **352-364, EUSTON ROAD, LONDON, N.W.**

Works: LONDON, LIVERPOOL, BRISTOL, GLASGOW, FALKIRK.